

**DUODENAL AND JEJUNAL
PEPTIC ULCER**

TECHNIC OF RESECTION

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BY

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U S A

Foreword

IT HAS become increasingly evident to the American surgeon during the past few years that the surgical management of ulcer is a complex problem. The passage of time has sufficed to indicate that the simpler techniques of gastrojejunostomy and pyloroplasty fail to meet adequately the demands of a satisfactory operation for ulcer. Moreover, the distrust of internists in the ability of surgeons to overcome the ulcer diathesis of a patient with a duodenal ulcer by operation is not without foundation. Actuaries tell us that a frequent cause of death in patients who have undergone surgery for ulcer is recurrent ulcer with attendant complications. The rejection of patients with ulcer, with or without operation, for active military duty reflects the mistrust of medical military officers in the ability of physicians or surgeons to rehabilitate ulcer patients for the strenuous exigencies of war. And whereas remarkable reductions in the mortality of appendicitis and intestinal obstruction have been occurring in this country during the past decade, perusal of the mortality tables of the Bureau of the Census indicates that the mortality of ulcer has remained uninfluenced by therapeutic procedures during the last three decades. Moreover, the morbidity of ulcer is equally if not more important than the considerations of mortality alone.

The empiricism of the surgeon in his wrestle with the ulcer problem is coming to an end. Whether an operation affords any protection against the ulcer diathesis can be put to critical test in the experimental laboratory. Operations which fail to protect the dog against the histamine in beeswax-provoked ulcer are likely to be followed by recurrent ulcer when such operations are employed in the surgical treatment of ulcer in man. Furthermore, this same histamine in beeswax technique for the production of ulcer in the dog has proved of real value in testing the authenticity of assertions or the validity of practices

with reference to various features or components of any operation alleged to affect the ulcer diathesis favorably.

Dr. Rudolf Nissen, steeped in the tradition of a long and thorough period of training in surgery and schooled in the exacting techniques of ulcer surgery, is well qualified to write on this subject. His contributions to this and other phases of surgery are well known.

It is very proper that Dr. Nissen should have stressed the importance of duodenal closure in the Billroth II type of operation for ulcer. Every surgeon who professes to do gastric surgery soon learns that satisfactory closure of the blind end of the duodenum is a *sine qua non* of a low operative mortality score. Dr. Nissen's study and survey of the available proposed methods of dealing with this difficult technical problem constitute an important addition to surgical literature.

Dr. Nissen's advocacy of the Billroth I type of gastric resection for uncomplicated duodenal ulcer is physiologically sound. Too often surgeons forget that the Billroth II type of operation, unless accompanied by an extensive gastric resection, invites ulcer recurrence. Furthermore, even an extensive gastric resection carried out on the Billroth II plan of operation, accompanied by a long afferent jejunal loop, is likely to be followed by stomal ulcer. It was no accident of nature that placed the biliary and pancreatic secretions so near the gastric outlet. Yet surgeons will affect to improve upon this arrangement by separating the new gastric outlet widely from the alkaline and pancreatic juices! It is little wonder that such operations are followed by stomal ulcer in a fairly large percentage of instances. In fact, that very technique, three-quarter gastric resection with a long afferent jejunal loop, has been employed in this laboratory for the experimental production of ulcer in the dog. On the contrary, following similar resections accompanied by an anastomosis made at the suspensory duodenojejunal ligament, ulcer cannot be provoked in dogs with the additional use of the unrelenting stimulation of gastric secretion afforded by

the histamine in beeswax implantation. The duodenal mucosa is the segment of the intestine which has the richest supply of secretin. The best physiologic stimulus for pancreatic secretion with high buffer values is the presence of acid in the duodenal loop. Surgeons cannot afford to neglect the great importance of the secretin factor in gastric resection for duodenal ulcer. Successful operations for ulcer must be physiologically sound as well as technically safe and correct. Fulfillment of the latter requirement assures survival of the patient; satisfaction of the first criterion suggests that the patient will remain well and free from ulcer recurrence.

OWEN H. WANGENSTEEN

Minneapolis, December 1944

Preface

This book deals with certain technical maneuvers illustrated by a series of drawings. The text is limited to an explanation of the rationale of the procedures and an amplification of the legends of the pictures. The objection may be raised that such a description of a technic recommended for operative treatment of a certain type of duodenal ulcer can be dispensed with. On the other hand, judging from my own material, about 75 per cent of all duodenal ulcers coming to operation belong to the category under discussion. Moreover, the ratio between duodenal and gastric ulcers submitted to surgery is about 7:1. Therefore in about 50 per cent of all cases in which surgical intervention for ulcer is indicated, the procedures herein described are applicable. It is common experience that in duodenal ulcers no part of gastric resection is more likely to be followed by serious complications than the closure of the duodenal stump.

Since my first publication on the subject, some twelve years ago, several similar methods based on the same principle have been published. This is considered sufficient proof of the fact that the principle is sound and that there is a need to replace the exclusion resection by a more radical procedure.

Elaboration of the technic of operation for jejunal peptic ulcer may be welcomed by those whose experience with this rare and complicated condition is limited. It is my opinion that the two stage operation, as described, is advantageous in poor risk patients.

All of the illustrations in this book represent original drawings and adaptations prepared by Ruth Nissen. I should like here to express my sincere gratitude to her and likewise to Dr. Edward Hirsch, for his help in the preparation of the manuscript.

RUDOLF NISSEN

New York, November 1944

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I

Duodenal Ulcer

GENERAL CONSIDERATIONS

A BRIEF discussion of certain clinical, anatomic, and pathologic factors may be helpful as a background for the operative techniques to be described in this survey.

As the common use of the expression "ulcer problem" implies, there are a number of unclarified questions relating to the pathology and especially to the etiology of peptic ulcer.

Most students of the disease have attempted to prove a single chief etiologic factor responsible. Thus one group, assuming extragastric influences—such as continuous excessive psychic strain, anxiety, or fear—to be mainly causative, has tended to underestimate the importance of the local phenomena. Another school sought to prove that ulcer development is preceded by inflammatory changes in the mucous membrane or by circumscribed circulatory disturbances and that factors explained on the basis of other genetic theories have no important bearing.

Experiences with peoples of different races, of very divergent psychologic background as well as disparate dietetic and nutritional habits, have indicated that different causes can nevertheless produce similar pathologic conditions. It will, however, be generally conceded that vegetative nervous system reactions to psychic stimuli are of paramount importance, especially in the large centers of population of more highly civilized countries. Considering the multiple psychic irritations to which the city resident is often exposed, it is remarkable that resultant somatic damage is not more frequently in evidence. Of the important organs that are dominated by the vegetative nervous system—such as the heart, liver, and intestinal tract—the

stomach is the most reactive to the constant stream of autonomic stimuli. A general appreciation of the influence of emotions on organic functions appears in the colloquialisms referring to "nausea" at the sight of a detested person and loss of appetite on receiving bad news. The secretory functions of the stomach, as well as its motor functions, are known to be modified by psychic irritation of any kind. Yet stimuli of similar quality and degree will have unpredictable effects on gastric secretion, leading to anacidity in one individual and hyperacidity in another. An attempt has recently been made by Wolf and Wolff to associate various reactions with certain well defined affective states. Their experiments seem to permit the conclusion that emotions involving conflict, hostility, resentment, and anxiety *increase* the function of the stomach, while fear, sadness, and other feelings involving a desire for withdrawal have a *depressing* influence on gastric secretion. To be sure, it is not easy to understand why emotions so intimately related as, for instance, fear and anxiety, should have opposite effects on the action of the stomach.

Although definite physical characteristics of an "ulcer type" are recognizable, the bearing of constitutional factors is not clear, for patients with comparable physical stigmata may be found to exhibit either hyperacidity or anacidity. Statistics do show, however, that a much larger percentage of men than of women develop peptic ulcer, just as the predisposing factor of hypersecretion is relatively more common in males.

In addition to the group of cases showing contributory symptoms of autonomic imbalance, many patients would appear to develop ulcer as secondary to the toxic effect of certain foods. There is no evidence that alcohol in any form plays more than an insignificant role. Our experience in Turkey, where tobacco smoking and coffee consumption are both excessive, indicates that both may be etiologically connected with ulcer, especially duodenal ulcer, though coffee would appear to be less culpable than tobacco. The definite effect of tobacco on the autonomic

nervous system has been established, so that it could be found responsible for the hyperfunction of the gastric mucosa. The mechanism of the action arising from heavy indulgence in coffee is probably similar.

In a third group of cases, undernutrition or malnutrition was according to our experience a definite causative factor. In certain parts of Europe and Asia, even before the actual war, during periods of severe food shortage due to lack of transportation or failure of the harvest, the great increase in the number of ulcer cases approached epidemic proportions. These starvation cases remarkably often presented very large ulcerations, practically always in the duodenum, and responded rapidly to treatment with adequate nourishment. The same patients, however, if subjected again to similar undernutrition would develop recurrent attacks, and were then less amenable to medical treatment. Clinical observations made on these patients led us to believe that low protein diet is the causative factor rather than lack of vitamins; this is in accordance with experiments of Harris, Abbasy, Yudkin, and Kelly.

As to the conditions prevalent in the organ in which the peptic ulceration is located, convincing evidence has been assembled to show that gastric hyperacidity is a *sine qua non*, at least in cases with duodenal and jejunal peptic ulcers. The maxim, "No ulceration in the absence of hyperacidity," has stood the test of all the investigations of the past eighty years, and excessive acidity remains the chief object of therapeutic attack. The relation between hyperacidity and gastritis in these cases is still an open question. Only a certain proportion of the stomachs resected for ulcer show the pathology of generalized gastritis. The area of inflamed mucosa consistently present is limited to the immediate vicinity of the ulcer itself, and undoubtedly represents a typical inflammatory reaction of the specific tissues involved by the process.

In any event, the therapy of today is focused on an attempt to re-establish normal secretory gastric function, though in past

years this point of view has often been held in low esteem. However, if it is granted that normal secretory activity is of primary importance for successful treatment, then obviously the disease itself lies essentially within the province of internal medicine. It is true, to be sure, that up to the present attempts to achieve permanent correction of hyperacidity by medicinal means have not been entirely successful. However, even the intermittent normalization of secretory function effected either by medication and diet or through treatment by duodenal intubation has brought about clinical improvement and even subjective cure in a large percentage of cases, though the figures for cures claimed for conservative treatment vary considerably. Consequently, except in the event of acute surgical emergency, operative intervention is not warranted in the average relatively benign case of peptic ulcer until the social and economic status of the individual patient has been evaluated and a thorough trial of medical treatment has proved to be of no avail. Lahey reports that only 8 per cent of the cases of peptic ulcer at his clinic come to operation—surely an admirable demonstration of surgical restraint. An elaboration of the indications for surgical intervention will be presented subsequently.

As has been remarked, peptic ulcer in most instances runs a benign course. Therefore, universal application of surgical measures to avert potential occurrence of perforation or hemorrhage is not justifiable in view of the relative infrequency of these complications, which can as a rule be prevented by conservative medical care.

On the other hand, if a high incidence of *malignant degeneration* of peptic ulcers could be proved, more frequent and earlier surgical exploration would be indicated. Opinions of authorities are somewhat divergent on this question, most authors, however, reporting a relatively small percentage (from 4 to 5 per cent) of malignancy in gastric ulcers. In Turkey, I found the percentage somewhat higher when the primary

diagnosis was that of gastric ulcer. All investigators agree, however, that duodenal ulcers, which are to be the subject of this discussion, very rarely become carcinomatous. Hence apprehension in this regard cannot properly constitute a surgical indication.

Since the early days of surgical treatment of peptic ulcer, it has been emphasized that besides extirpating the lesion, the operative procedure should include an attempt to aid in neutralizing the gastric secretions. It was hoped that gastro-enterostomy would accomplish this by leading the alkaline duodenal juices into the stomach. This "internal apothecary" theory, as it has been called, has had its warm adherents up to the present day, as shown by the recent literature. The usual preference for the posterior anastomosis may be ascribed to the fact that it is not commonly supplemented by a short circuiting *entero-anastomosis*, thus giving the duodenal contents free passage into the stomach. Because of the conviction that this neutralizing mechanism is of paramount importance, supplementary *entero-anastomosis* following the Billroth II resection was discredited, since this technic diverts the duodenal fluid directly and prevents its passage via the gastro-enterostomy. Some surgeons, as for instance Lahey, after performing a gastric resection and anterior anastomosis, refrain even here from performing a supplementary *entero-anastomosis*, in order to make certain that the duodenal fluid will flow into the residual stomach.

However, the figures for gastric juice acidity after partial gastrectomy with and without short circuiting anastomosis are not very convincing (Enderlen, Freudenberg, and von Redwitz; Keppich). Indeed, Starlinger saw fewer marginal ulcers following the Billroth II procedure *with* accompanying *entero-anastomosis* than following the Billroth II *without* *entero-anastomosis* (p. 94). It remains still to be proved that permitting the duodenal juice to flow directly into the jejunum is

disadvantageous. On the other hand, establishing a supplementary entero-anastomosis after the resection has one definite advantage: it serves the important function of evacuating the afferent jejunal loop and thus relieving tension within the duodenal stump, rupture of which is by far the most frequent cause of fatal complications following gastric resections. It has been stressed by several authors that reliable closure of the duodenal stump, even if performed in the classic way, cannot be guaranteed. We believe that separation of the stump is not always due to inadequate suturing, but may sometimes be caused by rupture due to overdistention from obstruction and back pressure.

After all, the high percentage of occurrence of jejunal ulcers following gastro-enterostomy shows that the chemical efficiency of the "internal apothecary" leaves much to be desired. Consequently, other means of achieving satisfactory and lasting control of the bugbear of hyperacidity resistant to medical treatment were diligently sought for. The most radical as well as most effective operation eventually proved to be that of excision of large portions of the mucous membrane of the stomach by the technically expedient procedure of gastric resection. While excision of the ulcer and of a small surrounding area of stomach was motivated by the emphasis upon the dangers of perforation, hemorrhage, or malignant degeneration, the present day optimum surgical procedure is considered to be that of excision of the ulcer combined with an extensive resection of the stomach.

However, opinions differ as to how much stomach should be resected. There is a tendency to abandon the so-called subtotal resection, which means resection of at least three-fourths or four-fifths of the stomach, in favor of a less generous removal. Of course from a theoretic point of view it would be advisable to use the degree of hyperacidity as an indication for the extent of resection. In other words, the greater the hyperacidity, the more stomach should be removed. Hener points out that

"there is in general a reduction of acid secretion in proportion to the extent of the resection. But resection of any magnitude consistent with a reasonable mortality does not insure achlorhydria. Moreover, when we compare the clinical results with the acidity, we again find a lack of correlation; for in minimal resection 90 per cent of the patients have satisfactory results while 25 per cent have a reduction in acid." Therefore it can be assumed that removal of one-half of the stomach can be regarded as an adequate resection, provided—and this has to be emphasized again and again—that the pylorus and the antrum also are excised.

At one period during the history of these developments, the so-called *palliative resection* was indorsed by Finsterer and quite extensively employed. The theory of this method minimized the importance of removing the ulcer in favor of resection of a large portion of the "healthy" stomach. In the case of duodenal ulcer, a successful technical result for such a palliative resection usually required leaving not only the ulcerated area but also the pylorus and a considerable part of the adjacent antrum in situ, although these structures play a significant role in the mechanism of gastric secretion. For while the mucosa of the antrum produces only a small quantity of rather weak juice (Edkins, Zukschwerdt), its hormonal activity via the blood stream (Edkins) seems to be a powerful stimulus to the acid-forming glands of the fundus. The physiologic process that Pavlov termed the second or chemical phase of gastric secretion has been assumed to originate in the antrum. However, it has not been conclusively established that the antrum is solely responsible for the hormonal stimuli, and hence it has not been proved that ablation of the mucosa of the antrum, as first proposed by Finsterer (1918), and later by Wilmanns, Bancroft, Wangensteen, and many others, will completely interrupt this reflex mechanism.

It is perfectly possible, although not as yet confirmed by animal experimentation, that the pylorus muscle may function in

relation to the fundus secretion much as does the antrum. Clinical observations indicate that the pylorus, left behind in the palliative resection, may operate to prolong the chemical phase as does an experimentally obstructed pylorus in animals (Morton, Elman and Eckert). On the practical side it must be said that in the excisions of the antrum mucosa that I have seen other surgeons perform, as well as in the few I have carried out myself, technical complications have sometimes been troublesome. Bleeding is usually profuse and difficult to control. There is also the inevitable doubt as to the adequacy of the blood supply remaining to the denuded muscular wall of the pylorus. Apparently Finsterer himself found little value in the maneuver, for he discontinued use of it after a period of trial.

To obviate the disadvantage resulting from the residual antrum plus pylorus, some surgeons (Zuk-schwerdt and Eek) attempted a transection of the duodenum proximal to the ulcer but just distal to the pylorus. However, according to my experience, the extensive infiltration and adhesions caused by penetrating ulcers of the posterior wall of the duodenum in that region will then usually prevent satisfactory and dependable closure of the duodenal stump. The same is true with regard to an antrum pouch of insufficient size left behind after exclusion resection.

The surgical problem is less complicated if the patient has the flat, nonpenetrating type of duodenal ulcer, which is usually double or multiple. These flat ulcers are not inclined to bleed profusely or to perforate, and they need not be excised, provided that a postpyloric section is made.

The operative technic to be described applies to the penetrating, so-called "nonresectable" ulcers, which comprise a large majority of all duodenal ulcers. Besides their relative frequency, they are of practical importance to the surgeon for a number of other reasons. They are the most resistant to medical treatment, they cause more intense subjective symp-

toms and greater hyperacidity, they show more tendency to hemorrhage than is the case with gastric ulcers. Their frequent occurrence as compared to gastric ulcers is illustrated in our own material, in which the ratio of duodenal to gastric ulcers is 7:1 (in those cases coming to operation).

Because of the above outlined considerations, numerous apparently minor and seemingly insignificant details of technic will be elaborated upon in the description to follow. It should be appreciated that the success or failure of the duodenal stump closure may depend on the placing of a single suture. The fact that to this day the method of exclusion resection is often favored proves that the technic of closure after radical operation for penetrating duodenal ulcer is not yet regarded as dependable.

It may be granted that the Finsterer operation, in which the operative field is restricted to normal stomach tissue, has been developed into a standardized and routine procedure that can be entrusted to surgeons of limited experience without undue risk to the patient. Nevertheless, the mortality figures for this operation are quite high, again considering that the tissues involved are those of a normal organ, anatomically speaking. Fatalities may be due to peritonitis secondary to rupture of the inverted antrum, or to hemorrhage from or rupture of the ulcer itself, which has been left in situ.

The inverted and sutured antrum after resection shows especially great tendency to rupture in those cases in which there is marked stenosis of the region of the ulcer, because the mucous secretions or blood accumulations back up under increased pressure.

Statistics show the immediate mortality rate for the Finsterer operation to be fairly high—5.3 per cent according to the report of Zukschwerdt and Horstmann in 1936 covering 1834 palliative resections. But fatalities following secondary operation for resection of jejunal ulcer should properly also be included, and the incidence of this postoperative complication is known to be high.

Though Finsterer himself found a rate of only 4.8 per cent, a recent report by Kiefer of the Lahey Clinic lists thirty Finsterer operations, of which seven were followed by development of postoperative jejunal ulcer. In 1933 I reported the occurrence of 4 cases of postoperative marginal ulcer after eighteen palliative resections. Of course, this is too small a series to be of real statistical importance, but it emphasizes the fact that quite a number of cases require a secondary, technically more difficult surgical procedure with an accompanying higher mortality risk. In other words, *a conspicuous proportion of patients who have had seemingly successful Finsterer operations succumb later to surgery undertaken to cure them of postoperative jejunal ulcer.*

This aspect of the situation would seem to justify the radical removal of any duodenal ulcer, provided the operative risk is not too great.

The components of this risk may profitably be subjected to analysis. They derive chiefly from factors due to the character of the local pathology and to the degree of technical competence of the surgeon. A primary aim of this survey will be to present more or less standardized techniques that, while atypical, are applicable to frequently occurring pathologic situations. Obviously such plans of procedure should be of assistance to the operator who has had more or less experience in the typical operations of gastro-intestinal surgery and has mastered the fundamentals of their routine, and cannot be expected to provide a substitute for this prerequisite experience at the operating table. However, it may be credited to the simplicity and reliability of the method to be described that 200 radical resections of penetrating duodenal ulcer of the posterior wall reported by the author in 1938, were performed by six different surgeons of his department, three of whom had only limited experience in gastric surgery.

In the literature dealing with the surgery of duodenal ulcers, much attention has been devoted to questions concerning *non-*

resectable or inoperable duodenal ulcers. Variation in the figures of incidence for these in the statistical reports of individual surgeons is probably due in part to subjective differences of interpretation and definition. Table 1 illustrates this variation.

TABLE 1.—*Variations in Percentages of Nonresectable Ulcers*

AUTHOR	PERCENTAGE
Mandl (1930)	58
Jacobovici (1932)	50
Koenig*	14
Zukschwerdt and Eek (1932)	19
Berger* (1932)	8

* Figures as given in Zukschwerdt, L., and Horstmann, H. *Ergebn. d. Chir. u. Orthop.* 29: 440, 1936.

It is significant that as the surgeon's skill develops, the number of duodenal ulcers that he classifies as not resectable without undue risk is apt to decrease. This is illustrated in table 2.

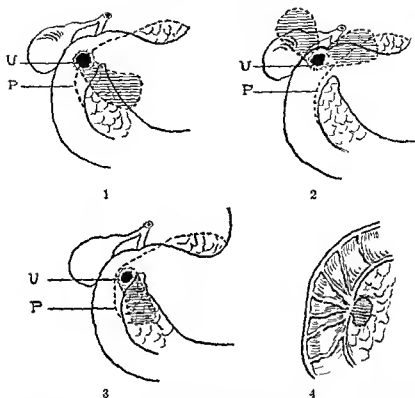
TABLE 2.—*Variations in Percentages of Nonresectable Ulcers on Basis of More Extended Experience*

Author	Percentages	
	First Report	Later Report
Finsterer	16.6	6.0
Flürcken	20.0	10.0
Ruge*	80.0	3.3

* Figures as given in Zukschwerdt, L., and Horstmann, H. *Ergebn. d. Chir. u. Orthop.* 29: 440, 1936.

The decision that an ulcer is nonresectable is usually based on the presence of one or another of the following anatomic situations (figs. 1-4): (1) involvement of the papilla of Vater or its vicinity in the ulcerated area; (2) extensive penetration into the hepatoduodenal ligament, with presumable involvement of the common duct; (3) penetration into the gallbladder.

The frequency with which these findings are described in the surgical literature contrasts with the infrequency of discovery



FIGS. 1-4. VARIOUS DIRECTIONS OF PENETRATION OF DUODENAL ULCERS

u = ulcer p = pancreas

Fig 1 Ulcer of posterior wall close to inferior border penetrating into pancreas and gastrocolic ligament

Fig 2 Ulcer of anterior wall penetrating into gallbladder or gastrohepatic ligament.

Fig 3. Ulcer of posterior wall penetrating into pancreas

Fig 4 Longitudinal section of duodenum with penetrating ulcer of posterior wall The folds of the mucous membrane converge toward the ulcer

of the first two conditions at autopsy. However, this contradiction is more apparent than real, for the following reasons. External observation or palpation may indicate possible

penetration into the region of the papilla or the common duct, whereas if the anterior wall of the duodenum is exposed and mobilized, the topographic relation to the anterior wall will reveal that the depth of the penetration has been overestimated. Ulcers extending to the immediate vicinity of the papilla are so rarely encountered that for practical purposes they need not be considered here. Figures 5 and 6 give an impressive demonstration of the relatively large distance between the usual location of duodenal ulcer and the papilla of Vater. In this case, gastroduodenal resection for bleeding duodenal ulcer was performed elsewhere. I have seen only one case in which the X-ray films suggested that the ulcer cavity might extend to the papilla. The patient had mild symptoms and did not come to operation.

Perforation into the hepatoduodenal ligament creates serious difficulty only if, as is rarely the case, the common duct is found to lie in the open ulcer cavity.

In our material, we encountered 3 such cases, in 2 of which insertion of a T tube into the common duct appeared effective and healing was prompt. In the third, I thought it would suffice to cover the defect in the duct with epiploon. However, although a subphrenic abscess developed, rupturing spontaneously through the incision, the patient recovered.

Lahey introduces a T drain into the common duct in all cases in which involvement of the duct seems probable (figs. 7-9).

Penetration into the gallbladder is not in itself a sufficient reason for voting against resection. The gallbladder should be removed at operation, if, as is usually the case, its wall is found to be indurated. However, if ulcers penetrating into the gallbladder also extensively involve the anterior duodenal wall, resection should not be attempted. As will be explained in detail later, large ulcers of the anterior duodenal wall are very apt to be nonresectable, in contrast to those of the posterior wall or of the greater or lesser duodenal curvature.

Among 220 operations for duodenal ulcer reported by the author in 1938, there were only 3 cases in which the term "non-resectable" was justified. In one of them, cicatrization of



FIG. 5 ROENTGENOGRAM OF PATIENT WHO HAD SUBTOTAL GASTRECTOMY FOR DUODENAL ULCER

One year later, during the course of another operation, it was possible to take a cholangiogram, which clearly showed the considerable distance between what is apparently the duodenal stump, and the entrance of the common duct into the descending portion of the duodenum.

multiple ulcers of the anterior and posterior walls had reduced the duodenum practically to a fibrous cord, so that a dependable duodenal closure could not have been effected, therefore

a Finsterer operation was performed. In the other two, in both of which there was penetration into the gallbladder, we attempted without success to mobilize the anterior duodenal

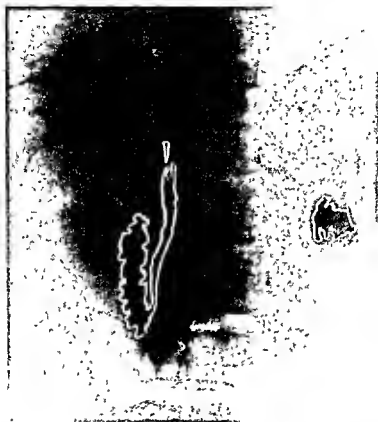
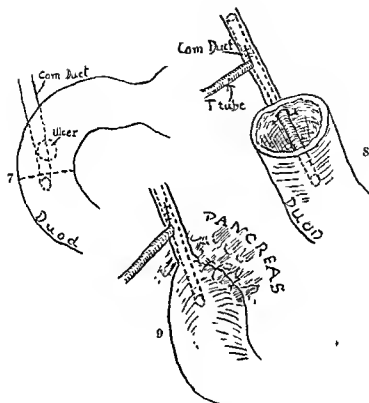


FIG. 6. SAME FILM AS IN FIGURE 5, WITH DUODENUM AND COMMON DUCT OUTLINED

A small amount of radio-opaque medium is seen in the afferent jejunal loop

wall before exposing the ulcer cavity itself (fig. 10). This situation, in our opinion, is a contra-indication for the radical operation, as was confirmed by our own experience in these 2 cases in which, influenced chiefly by the work of Doberer, we



FIGS. 7-9 LAHEY'S PROTECTIVE MEASURE IN POSTERIOR WALL ULCER ADHERENT TO COMMON DUCT

Fig. 7. Location of ulcer in relation to common duct. Level of dissection marked by dotted line. Ulcer crater apparently far proximal to line of resection.

Fig. 8. T tube prophylactically inserted in common duct to avoid obstruction of duct by suture or by inverted stump.

Fig. 9. Final result.

(From Lahey, F.: *Surg., Gynec. & Obst.* 76: 643, 1943. *Permission Surgery, Gynecology and Obstetrics*)

nevertheless attempted the radical procedure. These ulcers had perforated into the gallbladder and in each case only

minimal mobilization of the anterior duodenal wall was possible. After excision of the ulcers, it was indeed evident that a satisfactory inversion of the stump could not be achieved. The emergency procedure illustrated in figure 10 and figures 68 to



FIG. 10 OPEN DUODENUM AFTER TRANSECTION AT LEVEL OF ULCER,
SHOWING ANTERIOR WALL INSUFFICIENT FOR CLOSURE

This situation does not allow of any sort of inversion suture without undue tension. The method of handling this problem, which is of course the consequence of badly planned resection, is shown in figures 68-76.

76, which had already been employed in one earlier case of duodenal ulcer, was used here.¹

¹ The same method was also successfully used in a case of cancer extending beyond the pyloric ring, as well as in a case of cicatricial stricture of the duodenum in association with a jejunal peptic ulcer.

It should be understood that in this discussion our aim has been to narrow the concept of nonresectability purely upon the basis of the local findings. Obviously, the general criteria pertaining to the patient's physical condition, age, obesity, etc., may in themselves contra-indicate any prolonged or complicated surgery. But these matters are beyond the scope of this discussion.

The general decision as to *whether surgical intervention should be advised or not* must depend in considerable degree upon the nature of the operation that the surgeon chooses for a given case. It may be well to stress again that no case of chronic peptic ulcer should be submitted to surgery until the results of a course of medical treatment have been patiently observed, provided that perforation or hemorrhage does not complicate the situation.

However, it does not seem logical to regard the percentage of cases that the surgeon decides to operate upon as having much bearing on the fundamental problem of surgical indication or contra-indication. Hinton and Church reported that 4 per cent of their cases called for operation, while from the same city (New York), at about the same time, Heller, Holman, and Cooper reported that 34.8 per cent of their cases required operation. Such statistics are usually influenced to a considerable extent by certain imponderables that have no direct clinical implication, such as selection of cases for admission, etc. It must also be appreciated that the social or economic status of the patient will frequently sway the internist as well as the surgeon in the direction of the operating table. Prolonged and repeated dietetic regimens that subordinate the patient's whole existence to his ulcer are often too heavy a strain, and may not even be *feasible, especially during periods of restricted food supply.*

Dietetic prescriptions cannot be followed by the patient who returns from the hospital to living conditions that scarcely permit satisfaction of hunger, to say nothing of choice of diet. Such situations must also influence the question of the surgical

indication, as the author could fully appreciate during six years of practice in Turkey. There he was also surprised to find that many patients who had undergone radical operations for ulcer became essentially independent of diet restrictions, a fact quite at variance with statements in the literature. It was particularly true in cases of extensive ulceration. In fact, *the end result of the radical operation was the better, the more severe the local pathology found at operation.*

However, the same does not hold true for the duration of the disease. In general, the question of surgery does not arise until a considerable time after the onset of symptoms. It is common experience that a history of repeated acute attacks with accompanying gastritis decreases the chances of post-operative freedom from symptoms.

Clearly then, generally applicable rules governing surgical indications cannot be formulated and statistics as to the percentage of cases requiring operation can have little practical value.

The diversity of opinions regarding two frequently discussed situations—*repeated hemorrhage* and *duodenal stenosis*—may be cited. Many physicians and also surgeons feel that the case presenting repeated hemorrhages should be treated medically, whereas some believe surgery to be obligatory. Others advise operation only in patients over 50 years of age, because fatal bleeding is more likely if the resilience of the arteries is reduced by atherosclerosis. Although we have been inclined to operate for hemorrhage, we have not observed any unfavorable influence of conservative treatment on the prognosis in the older age groups.

There are also varied opinions regarding duodenal stenosis. In our experience with a considerable number of such cases, we have found that although they may be free of symptoms for a long period, they are likely to develop further ulceration, or the stenosis itself may become progressive, thus necessitating operation. Hinton and Church, however, state that symptom-

free duodenal stenosis does not present an operative indication. Such conflicting opinions as these will naturally result from differences in individual experience. But in any case the number of observations is usually too small to form a basis for the formulation of categorical principles.

However, it will be generally conceded that the whole question of operative indication must be viewed in the light of the *choice of elective surgical procedure*. Thus those who hold that *gastro-enterostomy* or *palliative resection* is the method of choice for duodenal ulcer should be cognizant of the fact that from 12 to 30 per cent of either of these operations are followed by development of jejunal ulcer, whereas the incidence after the radical procedure does not exceed about 2 per cent. Surgeons who prefer palliative methods should therefore restrict operative indication to such emergencies as rupture or rapidly progressing penetration. Another indication for palliative intervention may be presented in some cases of repeated profuse hemorrhage, although experience has proved that here too the end results of palliative operations are frequently unsatisfactory. The surgeon will naturally be tempted to attack the immediate source of the bleeding, which would involve exposure of the floor of the ulcer and ligation of afferent vessels as well as all bleeding points. A gastro-enterostomy may then be performed in order to reduce to a minimum the danger of further hemorrhage from autodigestion. But, despite these precautionary measures, severe postoperative bleeding may occur. This happened on the sixth postoperative day in a case of mine in which there was a large ulcer on the posterior duodenal wall. The lesion had been freely exposed through an incision in the anterior wall, all contiguous vessels had been carefully ligated, and gastro-enterostomy had been performed, but apparently autodigestion in the floor of the ulcer had not been checked. The resection that now became imperative had to be carried out under even more unfavorable conditions than the primary palliative intervention.

Opposition to the *radical operation for penetrating duodenal ulcer*, regarding which certain favoring points have been indicated, is frequently based on the premise that the procedure involves relatively greater risk than the palliative method. This opinion can pertain only to a radical procedure, as used for instance in malignancy. This in a case of ulcer would include complete extirpation of the floor of the ulceration. Dissection from the pancreas unquestionably may produce dangerous complications. Simple incision of the gland may lead to pancreatitis. Any escape of pancreatic juice may cause fat necrosis, which will also damage epiploon applied as a lining for the resulting defect in the pancreas, and threaten the permanent closure of the duodenal stump by digesting the sutures. In penetrating ulcers of the posterior duodenal wall, the common bile duct, occasionally the hepatic artery, and the duct of Wirsung may be markedly dislocated owing to adhesions, so that these structures may readily be damaged in the attempt to excise the floor completely. Indeed, the gravity of these potential dangers is out of all proportion to the relatively benign character of the disease itself.

Some time ago, Pauchet—as the first to do this—adopted the practice of refraining from excision of the base in penetrating ulcers of the posterior wall and the lesser curvature of the stomach, although the anatomic conditions here are certainly less complicated than in penetrating duodenal ulcer. It seems to be only logical to apply the same principle to the latter.

The exact details of the technic of duodenal ulcer resection used by individual surgeons are often not given in their reports. Von Haberer, for instance, who was one of the first to sponsor the principle of radical excision of peptic ulcers, says in his description that he “cauterized the base of the ulcer of the posterior duodenal wall, after exposing it clearly to view, and in this way cleaned the entire ulcer niche out of its pancreatic capsule.” Apparently he felt that removal of the niche is necessary and replaced excision with cauterization, which

may be less dangerous. It was only later that he abandoned this radical view, as will be mentioned subsequently.

A drawing published by Lewisohn in a report of A. A. Berg's technic (1934) shows that "if the ulcer has perforated into the pancreas, the base of the ulcer is left in contact with this organ by careful dissection around the ulcer."

In any event, as the results in hundreds of cases have shown that there are no untoward results from leaving the floor of the ulcer in situ even if cauterization, suturing, or covering over of the surface is not employed, we believe that this course should be followed in penetrating duodenal as well as in gastric ulcer.

The question arises as to how the closure of the duodenum can best be made in these cases. To effect the so-called standard closure, a considerable degree of mobilization of the posterior duodenal wall distal to the ulcer crater must be achieved, to permit inversion of the stump with a single or double row of sutures. However, the most frequent and severe inadvertent secondary injuries are due to the surgeon's efforts adequately to free the posterior duodenal wall. Identification of ducts and blood vessels is made difficult because of the dense inflammatory adhesions near the margins of the ulcer and between the posterior duodenal wall and pancreas. Many very vascular adhesions have to be divided, so that the posterior wall, when finally mobilized, may have an insufficient blood supply, with resulting danger in using it to invert the duodenal stump. Hence, it was only logical to discard the classic method of closure and to utilize only the healthy, definitely viable portions of the duodenal wall. The need of some such technical modification must have been widely experienced, for other surgeons published similar suggestions soon after the author's contributions of 1932 and 1933 (von Haberer, 1933; Gohrbandt, 1933; Bsteh, 1933; Koch, 1935; R. Graham, 1938; Wangenstein, 1940; McNealy, 1942). Only the later reports on this topic have been from North American sources; this is probably because gastric resection for duodenal ulcer was adopted here with

less enthusiasm than on the European continent. On this side of the Atlantic, the palliative resection has largely been favored in the past. On the other hand, we have sought to develop a more radical and yet safe procedure for duodenal closure for the very reason that our experience with the palliative resection was so unsatisfactory.

The discussion thus far has dealt primarily with penetrating ulcers of the posterior wall, which constitute 75 per cent of all operated penetrating duodenal ulcers in our material. Of the remaining 25 per cent, 10 per cent were ulcers of the anterior wall involving the gallbladder or the right lobe of the liver; 12 per cent had invaded the hepatoduodenal ligament; and 3 per cent had penetrated the pancreas and mesocolon from the lower border of the duodenum (fig. 11). The technic for the last two variants should proceed along much the same lines as that for the typical penetrating ulcer of the posterior wall. The difficulties that may be encountered in penetrating ulcers of the anterior wall have already been discussed (p. 25).

ANATOMIC FEATURES

As an introduction to the description of the detailed operative technics, a few of the more important anatomic relations may well be mentioned.

THE GASTRODUODENAL AND PANCREATODUODENAL ARTERIES

Both of these vessels may be included in the area of a penetrating ulcer of the posterior wall (figs. 12-14). Cicatricial contraction may cause marked upward displacement of the large gastroduodenal artery at the point where it divides into the pancreaticoduodenal and right gastro-epiploic branches (figs. 15, 16). Erosions in the base of the ulcer are more apt to involve the superior pancreaticoduodenal than the gastroduodenal vessel. It should also be noted that the gastroduodenal artery often lies close to the proximal border of the ulcer crater and may be damaged when sutures are carried

through the thickened sheath of the pancreas. The course of this vessel should be ascertained by palpation before the needle is passed. Ligation of this artery has not in my experience led to necrosis. However, accidental puncture, while not requiring special measures, may be troublesome, owing to formation of a hematoma. If the penetrating ulcer of the

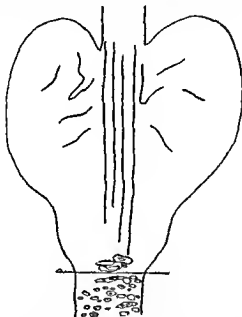


FIG 11 LOCATION OF PREPYLORIC AND DUODENAL PEPTIC ULCERS

Schematic drawing adapted from Orator The preferred location on the posterior wall is evident

(From Sauerbruch, F., and Schmieden, V. (ed.). Bier, Braun, and Kümmell: *Chirurgische Operationslehre*)

posterior wall is in the upper duodenal segment, it is important to remember that the right gastric artery occasionally springs from the gastroduodenal artery.

THE COMMON BILE DUCT

The common duct is not likely to be sutured by mistake, as it lies at a variable distance from the ulcer proper, even when there

is marked cicatricial contraction (figs. 12, 13, 15, 17-19). Moreover, the portion of the posterior wall adjacent to the duct is rarely ulcerated, and the distal end of the duct, which passes through the head of the pancreas in 65 per cent of cases, is

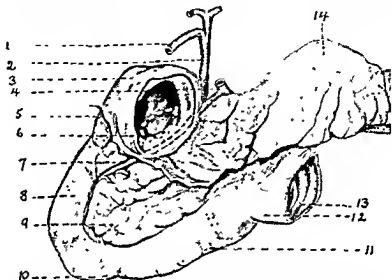


FIG 12. ANTERIOR VIEW OF STRUCTURES ABOUT HEAD OF PANCREAS

Dotted line indicates usual site of duodenal ulcer of posterior wall 1 = cystic duct. 2 = common bile duct. 3 = pars horizontalis superior and flexura duodeni. 4 = hepatic artery, ramus ascendens 5 = parietal peritoneum. 6 = common location of ulcer 7 = superior pancreaticoduodenal artery. 8 = pars descendens duodeni. 9 = head of pancreas. 10 = pars horizontalis inferior duodeni 11 = pars ascendens duodeni 12 = duodenojejunal flexure. 13 = jejunum 14 = body of pancreas.

(Adapted from Braus, H.: *Anatomie des Menschen*)

usually separated from the floor of the ulcer by a cushion of pancreatic tissue (figs. 13, 18).

THE PANCREATIC DUCT

The chief pancreatic duct is still farther away from the immediate surgical field (figs. 13-14). However, an accessory duct may lie in the field, or its open end may be exposed in the crater of the ulcer (fig. 19), and this possibility is another

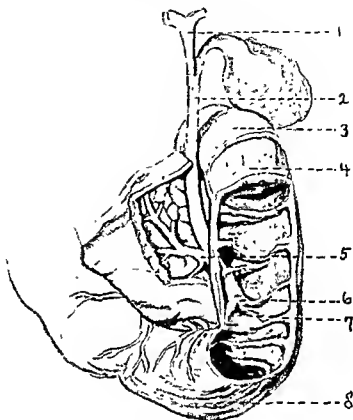


FIG 13 POSTERIOR VIEW OF HEAD OF PANCREAS AND SURROUNDING STRUCTURES

1 = common hepatic duct 2 = common bile duct 3 = pars horizontalis superior duodeni (covered with serosa) 4 = muscularis duodeni (retroperitoneal). 5 = main pancreatic duct joining common bile duct just proximally to papilla of Vater, as seen through window of pancreatic tissue 6 = papilla of Vater 7 = pars descendens duodeni. 8 = pars horizontalis inferior duodeni.

(Adapted from Braus, H Anatomie des Menschen)

very good reason for not dissecting the duodenal wall from the underlying pancreas. Technical steps for dealing with a patent pancreatic duct in the ulcer will be described later on.

Comment has already been made on the usual relations of a penetrating ulcer to the hepatoduodenal ligament and cystic duct, and also regarding penetration of an ulcer of the anterior wall into the gallbladder or the quadrate lobe of the liver (figs. 1-4).

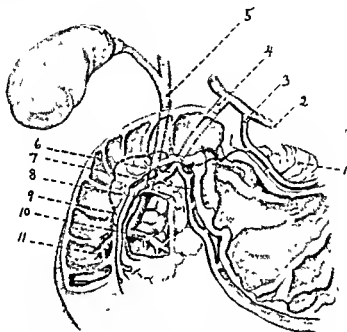


FIG. 14 ANATOMY ABOUT HEAD OF PANCREAS

This drawing emphasizes the important structures that are close to a duodenal ulcer of the posterior wall. 1 = pancreas 2 = hepatic artery 3 = right gastric artery. 4 = gastroduodenal artery. 5 = common bile duct. 6 = pancreaticoduodenal artery 7 = right gastroepiploic artery. 8 = common bile duct traversing pancreas (window of pancreatic tissue and capsule removed). 9 = lateral border of pancreas 10 = pancreatic duct. 11 = papilla of Vater

TECHNICS OF RESECTION

The essential features of the technical procedure in the radical operation for penetrating duodenal ulcer involve *adequate mobilization of the anterior duodenal wall, ample exposure of the crater, and avoidance of any surgical manipulation of the*

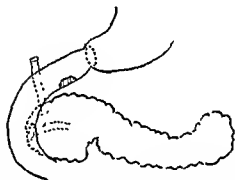
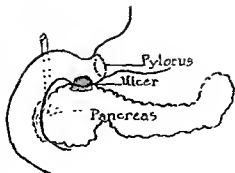


FIG. 15 SCHEMATIC DRAWING SHOWING HOW MORILIZATION OF POSTERIOR DUODENAL WALL BRINGS FIELD OF OPERATION IN DANGEROUS PROXIMITY TO COMMON DUCT

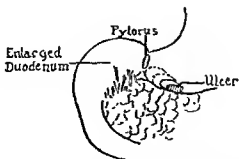
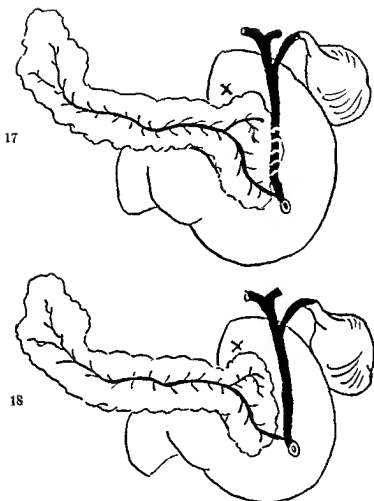


FIG. 16 PROGRESS OF PREPYLORIC ULCER TO STRICTURE OF PYLORUS
Scar formation extends to posterior duodenal wall. Atypical closure is advantageous



FIGS. 17-18. RELATION OF POSTERIOR DUODENAL ULCER TO PANCREAS AND COMMON DUCT AS SEEN FROM BEHIND

x = usual location of ulcer

Fig. 17. Portion of common duct running through substance of pancreas

Fig. 18. Common duct entirely extrapancreatic

posterior wall. Modification in technical details will depend on the location and size of the lesion, and this subject will be elaborated further on in our discussion.

Ample exposure of the duodenum and adjacent structures should be secured by the abdominal incision, whether median, paramedian, or subcostal. The site and size of the ulcer tumor are then determined by palpation. The size of the area involved by the lesion is not of great significance, unless the penetration appears to extend to the vicinity of the papilla of Vater. To determine this point, very complete *mobilization of the anterior wall* is essential. It has already been remarked that the degree of penetration is often difficult to judge and frequently overestimated. My own material has not shown cases of extension of the crater to the papilla as described by others in reporting "nonresectable" duodenal ulcers. Another

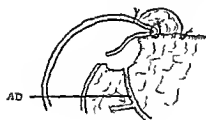


FIG. 19. ATYPICAL DUODENAL CLOSURE OMITTING FIRST SUTURE ROW IN PRESENCE OF ACCESSORY PANCREATIC DUCT

AD = accessory pancreatic duct

erroneous assumption, based on the presence of very firm adhesions in the hepatic portal region, is that the hepatoduodenal ligament is fused with the ulcer. If the anterior wall is freed from the mantle of adhesions, it is nearly always possible to free the hepatoduodenal ligament by blunt dissection. The technic of thoroughly exposing the anterior wall is perhaps the only part of the operation requiring considerable experience. The anterior wall is commonly found to be buried in a thick veil of adhesions, which must be penetrated to the exact extent of their depth, so that they may be peeled off completely. The best way to do this is with the apposed tips of the index fingers (fig. 20). With this accomplished, the anterior wall will spontaneously herniate out of the adhesions and expose its full width in loose transverse folds. If edema has infiltrated

and loosened the adhesions, the release of the anterior duodenal wall is greatly facilitated. The lower border of the duodenum

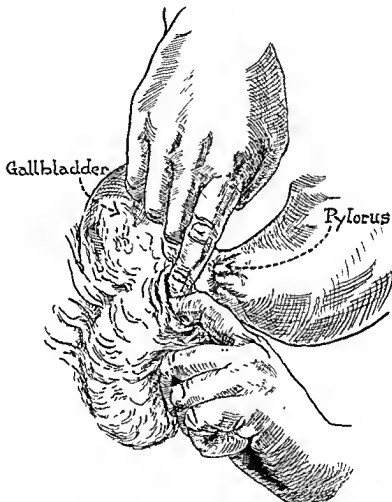


FIG. 20 FREEING ANTERIOR WALL OF DUODENUM

A transverse incision is made just below the pylorus. The coat of adhesions is thus divided until the serosa of the duodenum is exposed. The apposed index fingers are introduced into the cleavage plane between the adhesions and the anterior duodenal wall. The anterior wall is then freed by stretching and severing of the adhesions

and the head of the pancreas should remain clearly in view throughout, so that one may avoid damage to pancreatic tissue when exposing the duodenal wall. As soon as the anterior wall has been thoroughly exposed, one can judge whether sufficient healthy tissue will be available to permit inversion (fig 21). If there are no inflammatory or cicatricial changes in the anterior wall, the test of molding it in loose folds over the

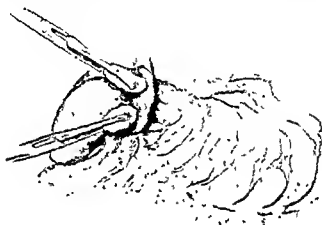


FIG 21 DECIDING WHETHER ENOUGH ANTERIOR WALL IS PRESENT FOR CLOSING DUODENUM BY OUR ATYPICAL CLOSURE

After release of the fibrous adhesions over the anterior wall, an artificial fold is formed by means of gauze pushers

area of ulceration will be successful; thereupon one may proceed at once with the resection.

Some surgeons next ligate the vessels that supply the chosen area of the stomach (from one-half to two-thirds), make the proximal section, move the organ toward the right, and then treat the ulcer area. Our practice has been first to tie the vessels in the prepyloric region and then to work on the duo-

denum, which is drawn upward by means of a strip of gauze passed beneath the prepyloric portion of the stomach. Special care must be exercised when ligating vessels adjacent to the lower border of the duodenum; sharp clamps should not be used, as they may inadvertently damage pancreatic tissue.

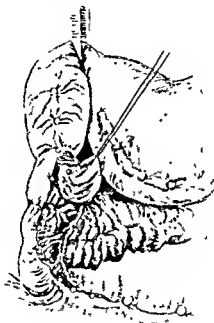


FIG. 22. PSEUDODIVERTICULUM OF FIRST PART OF DUODENUM

Visualized after incision of the gastrocolic ligament and mobilization of the duodenum in a case of posterior wall duodenal ulcer distal to the diverticulum. If the diverticulum is not adequately exposed, the line of resection may include the sac of the diverticulum and thus complicate the closure

If secondary stenosis has developed, the possible presence of a *false diverticulum*, usually located near the lower border, should not be overlooked (fig 22). The X-ray pictures will often suggest this possibility. At times the extrusion of the wall proximal to the stenosis is so considerable as to overlap the stenosed ring itself. Careful manipulation and complete

exposure of this redundancy will simplify the subsequent technic of duodenal section.

The freeing of the *hepatoduodenal ligament* from the upper border of the duodenum may be quite difficult, and very gentle handling is in order if dangerous complications are to be avoided. The branches of the right gastric artery should be

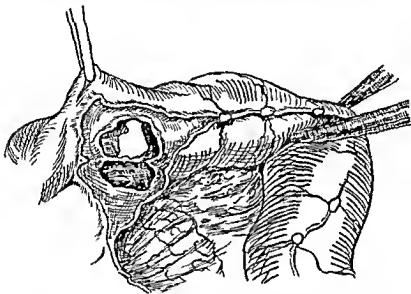


FIG 23. TECHNIC OF MOBILIZATION OF DUODENUM IN POSTERIOR WALL ULCER

After mobilization of anterior wall and devascularization of antrum and pylorus, crater of ulcer is opened close to greater and lesser curvatures

ligated close to the duodenal wall. If the larger branches are embedded in adhesions, the cut vessels are apt to retract and escape from the ligature. Therefore it is well to use double suture ligatures of fine silk. After the stomach has been clamped off proximally to the pylorus, the next step is incision of the duodenal lumen. The location of this incision will depend upon the extent of the ulcerated area. In the presence

of a large penetrating ulcer, it is best to search for a place where the posterior wall and the crater are fused together. An attempt is now made to enter the crater from the outside, in the manner employed in the case of penetrating ulcers of the posterior wall of the stomach. The separation of the posterior duodenal wall from the crater is limited to the half-circle nearest

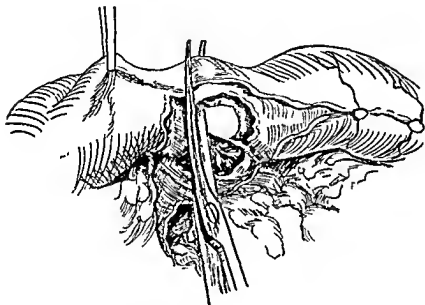


FIG. 24. TECHNIC OF MOBILIZATION OF DUODENUM IN POSTERIOR WALL ULCER

Scissors applied for dividing anterior wall. Dotted line indicates incision completing exposure of crater

to the pylorus (convexity toward pylorus) (figs. 23, 24). The crater of the ulcer is packed, and the mobilized anterior wall is then divided. This incision is placed as close as possible to the pylorus, though additional ulceration in this vicinity may require a more distal section. The cut surface of the anterior wall usually bleeds freely, and its vessels are secured with small clamps. A gauze sponge with a long, thick guy thread attached

is introduced quite deeply into the duodenum to prevent escape of duodenal contents (fig. 25). Only after the completion of the technical steps just described do we examine the surface of the



FIG. 25 SMALL BLEEDING ULCER OF POSTERIOR WALL PERFORATING INTO PANCREAS

After devascularization of the pyloric region of the stomach, the anterior duodenal wall is opened by a semilunar incision. A gauze sponge secured by a long thread is introduced into the distal duodenal lumen. The posterior wall is incised through all layers from within, as shown along the dotted line

ulcer for the presence of eroded vessels or an *accessory pancreatic duct*. In the few cases in which the patent mouth of such a duct was discovered in the ulcer floor, the amount of its

secretion was abundant. In the absence of such a complication, we then proceed with *closure of the duodenal stump*, as follows:

1. The first row of stitches, consisting of interrupted catgut sutures, unites the anterior wall and the opposite distal border of the crater adjacent to normal mucosa. We strictly refrain from making any move to detach the posterior duodenal wall from the rim of the crater or from the pancreatic sheath (fig. 26).

The second row, of interrupted silk sutures, is then superimposed on the first, uniting a fold of the anterior wall with the proximal edge of the crater (fig. 27). At the lower border of the duodenum these sutures are continued to reunite the peritoneal sheaths that were divided in exposing the duodenum.

The third row of sutures unites a second fold of the anterior wall with the pancreatic sheath, thus covering the preceding row. The sheath of the pancreas is usually indurated, owing to chronic inflammation (fig. 28). But before the sheath is pierced, the course of the gastroduodenal artery and the position of the arch of the pancreaticoduodenal artery must be ascertained by palpation (fig. 29). It is more prudent to pierce the pancreatic sheath beyond the site of these vessels. However, it has been found that bleeding due to accidental puncture usually stops spontaneously after compression; therefore ligation is rarely required.

For greater security, a layer of pedunculated epiploon may be stitched in position to cover the third suture line (figs. 30, 31).

2. Technical *modifications of the procedure* described above are indicated to meet the three following conditions: (a) small penetrating ulcer of the posterior wall; (b) evidence of free pancreatic secretion on the ulcer surface; (c) fulminating hemorrhage from the ulcer.

a) In the presence of a *small penetrating ulcer*, it is preferable to begin with a curved incision of the anterior wall close

to the pylorus, between two stay sutures. Through this opening the mucosa of the posterior wall is incised on a level with the distal margin of the ulcer (fig 25). Thus we have access to the junction of duodenal wall and pancreatic sheath, permitting

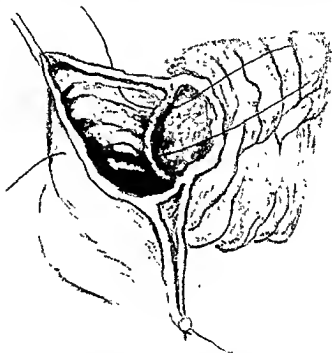


FIG. 26. CLOSURE OF DUODENAL STUMP

Step 1 The first layer of interrupted sutures is inserted through the distal margin of the ulcer and through all layers of the edge of the anterior wall of the duodenal stump

section of the posterior wall in conformity with the mucosal incision (figs. 23, 24) This anterior approach to the crater is less complicated than a posterior or internal route. The treatment of the duodenal stump proceeds as described in section 1 above.

b) In the presence of pancreatic secretion due to an open *accessory duct* in the floor of the ulcer, it must be remembered that occasionally this duct does not empty into the duct of Wirsung but emerges into the duodenum independently. In that case pancreatic juice will collect under pressure in the

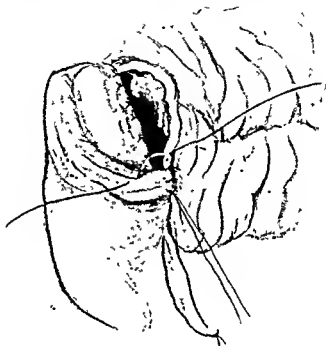


FIG. 27 CLOSURE OF DUODENAL STUMP

Step 2. The second row of interrupted sutures is inserted through the proximal margin of the ulcer and a seromuscular fold of the anterior wall. The cut edge of the duodenocolic ligament is closed by interrupted sutures

space between the base of the ulcer and the immobilized anterior wall (fig. 32). This pressure may cause loosening of sutures, or they may be consumed by digestion, permitting contamination of the peritoneal cavity. Finsterer reported a death due to duodenal leakage and peritonitis that he attributed to such a sequence of events after using our method.

In one case of mine, the occurrence of leakage from the duodenal stump was no doubt due to escaped pancreatic juice, which was seen to pour out on the ulcer floor during operation. The flow ceased when the mouth of the duct was identified and

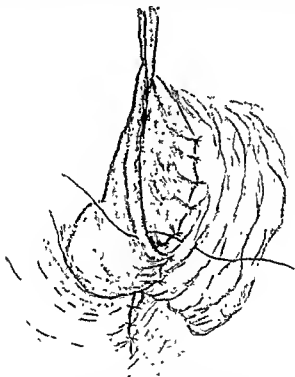


FIG. 28. CLOSURE OF DUODENAL STUMP

Step 3 The third row of interrupted sutures is inserted through the capsule of the pancreas (the capsule is usually thickened) and another more distal seromuscular fold of the anterior wall

ligated. The closure apparently did not hold, because this accessory duct probably was independent of the main duct, and therefore demanded a measure other than tying off. The patient recovered, but his convalescence would have been

less difficult if we had taken the steps necessary to assure free drainage of the juice into the intestine. This may at times be accomplished by merely dispensing with the first row of sutures between the anterior wall and the margin of the ulcer.

In a number of cases we omitted the first row of sutures entirely and healing nevertheless proceeded smoothly (fig. 19).

Another suitable technic is illustrated in figure 33. A small rubber tube is inserted between two sutures so as to drain the secretion of the ulcer crater into the duodenum. In 2 cases

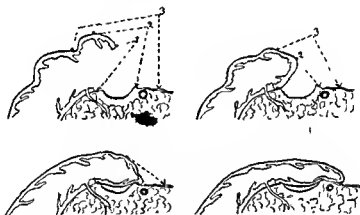


FIG. 29. CLOSURE OF DUODENAL STUMP

Atypical closure obviating injury to pancreaticoduodenal artery. The artery is palpated and the third row of sutures carefully placed in the pancreatic capsule beyond and above the artery

in which this was done—both presented very large ulcer craters—the tube was passed per rectum about a week later.

It should be emphasized that the presence of an open accessory pancreatic duct in the ulcer floor is an unusual finding, primarily because posterior wall ulcers rarely extend so far distally as to involve the site of such a duct. This complication could be clearly demonstrated in 3 of the cases cited above; in the others it was only suspected, owing to the profuse secretion from the ulcer floor.

c) Severe hemorrhages from duodenal ulcers almost invariably originate from erosions of branches of the gastroduodenal artery.

It must be extremely rare to meet in the duodenum the condition occasionally present in the stomach, namely, profuse bleeding springing from superficial ulcerations, without evident erosion of a larger vessel.

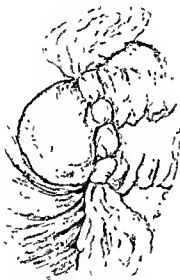


FIG. 30. CLOSURE OF DUODENAL STUMP

A segment of the omentum is tacked over the line of closure by means of interrupted sutures

A full discussion of the question as to indications for operation where hemorrhage is the chief and most urgent symptom is beyond the scope of this treatise. Be it noted, however, that authors differ widely as to the value of conservative treatment in fulminating bleeding. In our own experience, conservative treatment has usually been unavailing. If the history and previous X-ray films indicate the probability of a penetrating ulcer, and if the hemoglobin is decreasing rapidly, I believe that operation should be undertaken early, at times even during the first hemorrhage. Incidentally, X rays may be taken dur-

ing this critical time in cases of moderate but frequently repeated hemorrhages, for only a small amount of barium is required to reveal the mucosal pathology. We have seen this done repeatedly, without evidence of harmful effect.

The patient in hemorrhagic shock represents one of a few surgical emergencies that require rapid surgery. The operating

FIGS. 31-33. CLOSURE OF
DUODENAL STUMP

Fig 31. Longitudinal section of our atypical ulcer closure. D = duodenum. U = ulcer. E = epiploon.

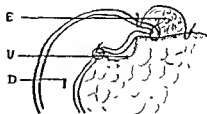


Fig. 32. Atypical closure in presence of accessory pancreatic duct with effusion of pancreatic juice into surgically closed space. F = pancreatic fluid collection.

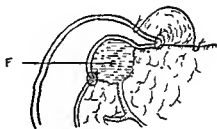
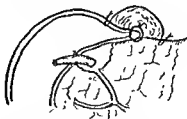


Fig. 33. Rubber tube inserted and fixed to anterior duodenal wall to insure escape of pancreatic fluid into duodenum



surgeon should be familiar both by sight and by touch with the rather complex anatomic and pathologic features of penetrating ulcers, and here experience is of importance.

The plan of operation should be as follows:

After a quick survey of the local conditions in the operative field, a proximal loop of small intestine is inspected for the presence of blood. If found, this indicates continued bleeding.

A heavy gastric clamp is introduced through a slit in the gastrocolic and gastrohepatic ligaments and the stomach is clamped to prevent escape of contents. Transverse incisions are then made in the anterior duodenal wall, close to the pylorus, in such a way as to form a free flap. This flap is turned back, and a sponge with string attached is pushed deep into the duodenum. Thus the ulcer is exposed, and search is made for an eroded vessel. It may be necessary to free the floor of the ulcer thoroughly of blood clots in order to identify the bleeding points. The involved vessel is ligated with medium silk above and below the eroded portion. The further procedure follows the description on page 40.

Certain conditions, such as adhesions between the anterior wall and the gallbladder, may prevent a sufficiently rapid dissection down to the anterior wall. It is in that case best to use the typical posterior route, while exerting firm pressure with a tampon upon the ulcerated area.

In desperate cases, after exposure of the ulcer floor by anterior duodenotomy, it may not be practicable to do more than quickly to tie the ligatures above designated. But there is no assurance that these will hold, and bleeding is likely to recur, owing to peptic erosion. This could presumably be prevented if all vessels supplying the ulcer were tied off. But dense adhesions commonly interfere with adequate exposure of the vessels of the pancreaticoduodenal arch, and a ligature en masse would be hazardous because of the proximity of the common duct (figs. 12-14). Furthermore, the rich collateral circulation in this area is likely to nullify the effect of even properly placed ligatures.

EVALUATION OF PROCEDURES

The author's technic was first published in 1932. In a paper appearing in 1933, von Haberer recounted his experience with it, and evaluated the procedure as practical and dependable. He stressed the point that use of it "enables the surgeon to

perform resection with excision of the ulcer in cases previously considered inoperable, thus reducing the percentage of so-called nonresectable ulcers," and says further: "My own practice for some time past had been similar to Nissen's when dealing with ulcers of the posterior wall that penetrated deeply into the head of the pancreas. I had not published a detailed description, believing, as did Nissen, that most surgeons understood these and their indications. Then I learned, however, from many visiting surgeons, that this was not the case . . .

"My technic differs from Nissen's in only one detail. He follows the preliminary steps of anterior wall mobilization, vessel ligation, and mobilization of the posterior wall up to the zone of penetration by freeing the duodenum from the ulcer base, and only thereafter incising the anterior wall. My modification is to open the anterior wall as the very first step, by transecting it with the cautery. Guy sutures, held by an assistant, are placed at each extremity of the area to be incised and stretch the gut taut. The advantage of this lies in the fact that via the cauterized opening the whole extent of the ulcer niche is plainly visualized. Section by cautery of the posterior wall close to the distal edge of the niche follows. This has the advantage of saving much more of the posterior duodenal wall laterally on either side of the niche, and also facilitates the placing and securing of the first row of sutures in the distal margin of the niche. The subsequent sutures are placed as Nissen describes them, with utilization of the proximal margin of the niche. If the voluminous seromuscular coat of the anterior wall is skilfully adapted, it provides a secure and permanent duodenal closure and secondarily effects the plugging up of the ulcer crater by the healthy anterior wall."

Von Haberer states that he has treated hundreds of cases by this method. According to his experience, there is occasionally an additional advantage in starting with the anterior wall incision if it permits peeling out of the complete crater from the thickened pancreatic sheath by means of the

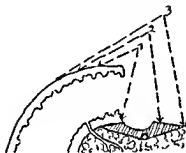
cautery. In my opinion, however, this is an unnecessary maneuver and there is danger of secondary damage to neighboring organs. On the other hand, there is no evidence that a remaining crater may cause an infection.

In the discussion on von Haberer's paper, Mandl agreed as to the value of the technic, and expressed the opinion that it represented definite progress in dealing with cases that up to that time had been treated by the exclusion resection operation. Mandl did not submit any case reports.

Bsteh published a paper concerning the subject a few months later, and the details of his method were in every way identical with those of my procedure (figs 34-37). None of the 20 cases he reported developed any postoperative leakage from the duodenal stump. He also felt that the method is far superior in its early and final results to that of the Finsterer operation (exclusion resection). In a further report in 1935 on 70 cases, some of them very complicated, Bsteh said that he had achieved permanent closure of the stump in every case and that he had in no case encountered even a temporary postoperative duodenal fistula.

Doberer adopted the method in his clinic without any modifications and published a report of results in 1936. He made the statement that judgment as to the applicability of the method could be favorable in cases in which the tumor mass was movable in the sagittal plane, either by palpation under the fluoroscope or after abdominal section. But this is questionable, inasmuch as the pancreas is firmly united to the ulcer and pancreatic mobility is variable and depends on constitutional factors. Doberer makes a noteworthy comment on the anatomic and clinical postoperative picture: "The topography established by completion of the Nissen operation, as seen in the illustration, shows the duodenal stump closely adjacent to the pancreas and freed of all pathologic tissue. It will obviously adjust itself readily to neighboring structures. The situation after the exclusion resection technic is much less

satisfactory, because here we have the duodenal ulcer-tumor with the pylorus attached and the dead end stomach pouch crowded into one area. This could be ignored perhaps, were it not that serious after-effects must be anticipated, because statistics show these to occur frequently. The most important of them is the jejunal peptic ulcer. The patient may escape this, but in any event his digestive functions, according to my



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36



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FIGS 34-37. TECHNIC OF DUODENAL STUMP CLOSURE ACCORDING TO BSTEH

1, 2, 3 = suture lines Oblique hatching indicates ulcer and ulcer base.

(From Bsteh, O.: *Chirurg.* 7: 249, 1935)

experience, will be more limited after the resection by exclusion than after the Nissen operation. The end results of this more radical procedure for penetrating ulcer are astonishingly good, in fact equal to those following resection of a simple ulcer. The rapidity of convalescence is surprising, and patients are soon able to enjoy a fairly liberal diet."

Doberer's statistics are quite striking. There were three

deaths among 47 cases, a mortality of 6.38 per cent; cardiac complications caused death in 2 cases, bilateral influenzal pneumonia in the third. Autopsy in all 3 cases revealed no pathology in the abdominal operative field.

As shown in table 3, this surgeon's percentage of deaths after applying our method is about the same as that following various other types of operation for ulcer over a six year period.

R. Graham published a description of a very similar procedure in 1938, under the title "Exteriorization of Posterior Wall Duodenal Ulcer." The size of the ulcer as illustrated is relatively small, thus permitting the greater part of the duo-

TABLE 3—*Doberer's Statistics of Mortality in Duodenal Ulcer Operations**

Operation	No. of Cases	Deaths	Percentage of Mortality
Typical resection	208	12	5.83
Modified resection (Nissen)	47	3	6.38
Exclusion resection	65	5	7.71
Gastro-enterostomy	65	5	7.71
Total	385	25	6.49

* From Doberer, *J. Chirurg.* 8: 509, 1936.

denal lumen to be closed by the typical serosa to serosa inversion. As to the all-important consideration, the management of the duodenum immediately surrounding the crater, he writes: "No attempt should be made to separate the duodenum from the undisturbed ulcer base" (figs. 38, 39). He dispenses with suturing the anterior duodenal wall to the distal margin of the ulcer crater (figs. 40-42). This provides a drainage canal, which, as mentioned previously, may be required in certain cases. Graham summarizes the advantages of the whole procedure as follows:

"First, it places a very effective plug in the ulcer base; second, should any infection occur, it will readily find its way into the lumen of the duodenum, which is completely retroperi-

tonealized; third, should there be any escape of pancreatic juice, it too will find its way readily into the duodenal lumen, and thus obviate any generalized fat necrosis. This maneuver will convert the adequate and entire excision of the pylorus in the presence of this extensive periduodenal involvement from a difficult technical procedure to one in which an adequate closure of duodenal stump can be carried out with speed and safety."

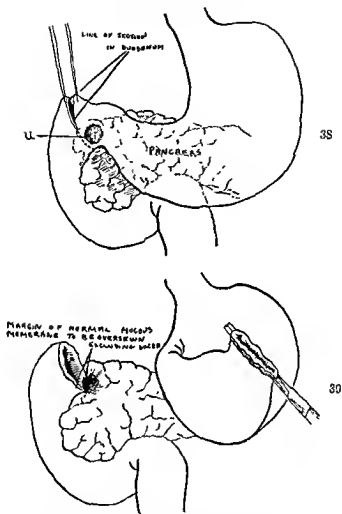
Graham does not state in how many of his 131 cases of gastroduodenal resection for duodenal ulcer (mortality 2.25 per cent) he applied this technic

O. H. Wangensteen, in a paper published in 1940, entitled "The Problem of Surgical Arrest of Massive Hemorrhage in Duodenal Ulcer; the Technique of Closing the Duodenum," describes his method of duodenal closure where mobilization of the posterior wall is either not possible or inapplicable. He says: "In the main, it is not possible. On the contrary, one must be satisfied with burying the closed duodenum in the anterior wall of the pancreas. Attending perforation of the duodenal wall, thickening of the pancreatic capsule occurs, making it practicable to employ it as an additional safeguard to secure effectual closure of the duodenum. This is the only feature of the operation that requires special comment."

Wangensteen's illustrations show that his technic is essentially similar to ours. However, he appears to favor excision of the floor of the ulcer in bleeding cases (figs. 43-48).

Our own experience is based on (1) 22 cases first published in 1932 and again in greater detail in 1933, (2) 17 additional cases reported in 1934, and (3) 220 cases reported in 1938. The mortality in each series was as follows:

Series 1 (1933). Among the 22 cases there was one death, caused by postoperative hemorrhage. Because of cholelithiasis, the gallbladder was also removed. At autopsy the source of the bleeding was not established. The convalescent course in



FIGS. 38-39. R. GRAHAM'S EXTERIORIZATION OF POSTERIOR WALL DUODENAL ULCER

Scheme for dividing duodenum and separating it from pyloric end of stomach, in presence of penetrating posterior wall duodenal ulcer. This procedure is carried out preparatory to exteriorizing the ulcer

(From Graham, R. *Surg., Gynec. & Obst* 66: 269, 1938 Drawings revised to omit clamps, by wish of Dr. Graham, since he no longer uses them
(*Courtesy Surgery, Gynecology and Obstetrics*)

FIGS. 40-42. R. GRAHAM'S EXTERIORIZATION OF POSTERIOR WALL DUODENAL ULCER

Method of closing duodenum, at same time exteriorizing base of posterior wall penetrating duodenal ulcer. No attempt has been made to remove this ulcer base from the pancreas, nor to mobilize the duodenum at its point of contact with the ulcer.

Fig. 40. Normal mucous membrane oversewn with two layers, thus excluding ulcer base.



Fig. 41. Interrupted sutures uniting peritoneal coat of duodenum to peritoneum of pancreas.

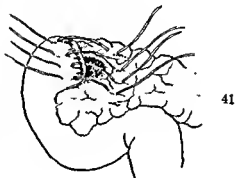


Fig. 42. Stump tied over in order to approximate suture line to ulcer base and completely cover area with peritoneum.



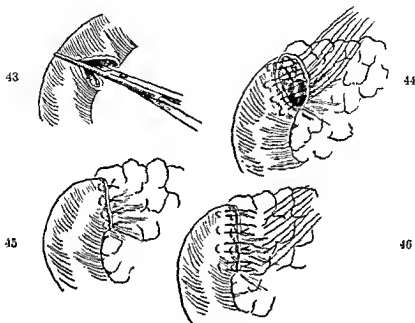
(From Graham, R: *Surg., Gynec. & Obst.* 66: 269, 1938. Drawings revised to omit clamps, by wish of Dr. Graham, since he no longer uses them. *Courtesy Surgery, Gynecology and Obstetrics*)

the other 21 cases was without incident; no duodenal fistulas developed, and during the two and one-half year period of postoperative observation, no jejunal ulcers.

Series 2 (1934). Among the 17 cases there were no deaths.

Series 3 (1938). Among the 220 cases, there were seven deaths—three from postoperative pneumonia, one from pul-

monary abscess, one from uremia, and one from volvulus of the small intestine. In 2 cases duodenal leakage developed but the patients recovered.



FIGS 43-46. WANGENSTEEN'S METHOD OF ARTIFICIAL CLOSURE OF DUODENUM IN BLEEDING PERFORATING ULCER OF POSTERIOR WALL

Fig. 43. Transection of the duodenum, starting from the inferior border, after the posterior wall has been dissected free down to about the proximal border of the ulcer.

Fig. 44. After adequate hemostasis in the ulcer crater, the anterior and posterior walls are approximated by mattress sutures that include all layers in the posterior wall and a seromuscular fold in the anterior wall. It is remarkable that the closure is performed allowing the ulcer to remain in the lumen of the duodenal stump.

Fig. 45. First suture line completed.

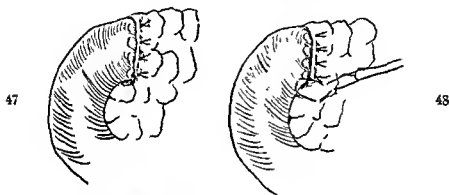
Fig. 46. The second suture line, of interrupted mattress sutures, approximates a seromuscular fold of the anterior wall to the capsule of the pancreas.

(From Wangensteen, O. H.: *Surgery* 8: 275, 1940. *Courtesy Surgery*)

The postoperative mortality in all these series taken together was therefore 3.08 per cent.

The operations performed by the author from November 1932 to April 1933 and from January 1937 to May 1939 have not been included, because detailed records are not available. The number of these would again be considerable²

It will be noted that the fundamental principles of the various technics of duodenal closure described above are much the same.



FIGS. 47-48. WANGENSTEEN'S ATYPICAL DUODENAL CLOSURE IN BLEEDING PERFORATING POSTERIOR WALL ULCER

Fig. 47. Second suture line completed.

Fig. 48. Inferior angle of duodenal stump suture taken through duodenum and capsule of pancreas

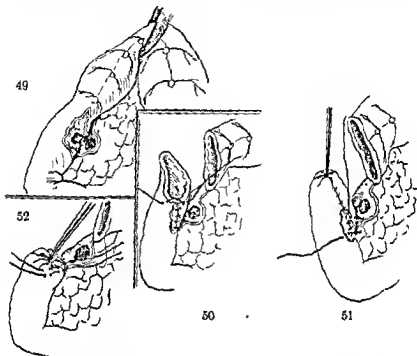
(From Wangensteen, O. H.: *Surgery S*: 275, 1940 *Courtesy Surgery*)

However, certain *modifications* were introduced by individual surgeons, and these will now be discussed.

In 1933 E. Gohrbandt, in referring to our paper, published the following modification. After exposing the ulcer and section-

² The report made in 1938 covered cases treated by operation up to December 1936. The total number of histories of operated ulcers on file at the University Clinic of Istanbul at the end of 1936 was 500, of these, 90 per cent represented resections. In the interval from that time to the date of publication of the report (1938), 200 more such operations had been performed, and a high percentage of these also were resections.

ing the duodenal wall for a distance of 0.5 cm. below the distal margin (fig. 49), he proceeds with his closure as shown in his sketch. The ulcer crater is not involved in the suture; it is



FIGS 49-52 GOHRBANDT'S TECHNIC OF ATYPICAL DUODENAL STUMP CLOSURE

Fig 49 After devascularization of the stomach and the first part of the duodenum, the posterior wall is dissected from the margins of the ulcer crater.

Fig 50 The resulting defect in the muscularis and mucosa of the posterior wall is closed by interrupted catgut sutures. The remaining stump is inverted by means of interrupted Lembert sutures.

Fig 51 The area not covered by serosa is approximated to the pancreatic capsule with a mattress suture of silk.

Fig 52 The conical stump is inverted by means of a series of Lembert sutures.

(From Gohrbandt, E. *Zentralbl. f. Chir.* 60, 185, 1933)

FIGS 53-55 KOCH'S METHOD OF
HANDLING DUODENAL STUMP

Fig. 53. a = line of resection. b = defect in posterior wall resulting from exposure of crater of ulcer. c = ulcer crater in pancreas.

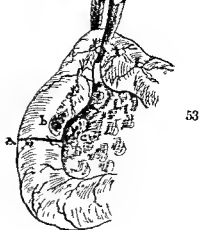


Fig. 54. a = hemostatic clamps applied to anterior and to posterior wall. Inversion of the wall for suture is facilitated by this maneuver. b = ulcer crater in pancreas.

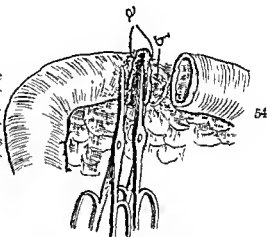
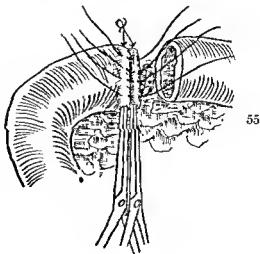


Fig. 55. By rotation of the clamps inward, the anterior and posterior walls are approximated and brought into position for application of the inversion sutures.



(From Koch, E.: *Zentralbl. f. Chir.* 62, 2951, 1935)

curetted and covered with mesentery. However, it would seem that this freeing of additional posterior wall is rarely advisable. In large penetrating ulcers the dense adhesions to the pancreatic capsule will prevent this step, and even when it is possible, the freed portion of the wall is apt to have an inadequate blood supply. However, it may well be possible to use this step in the case of small ulcers.

The primary sutures according to Gohrbandt's technic are placed in a cicatrized area of the wall that has been denuded of its serous coat, and we felt that they would be unlikely to hold (figs 50-52). Therefore, when we tried his technic, the portion of the pancreatic capsule distal to the crater was included in the second inverting suture for greater security.

Koch, the Russian surgeon, also uses the chief directives of our procedure, but he too considers it of advantage to free a segment of the posterior wall. He has devised certain technical maneuvers to aid in the inversion of the stump, as follows:

"When we have penetrated to the ulcer margin after sufficient mobilization of the posterior duodenal wall, the ulcer crater is incised and its complete circumference cut away from the posterior wall, as is done by Nissen [fig 53]. The base of the ulcer is then wiped out and iodine is applied to it. We then free a further segment of the posterior wall distal to the crater, as proposed by Gohrbandt. I do not section the anterior wall at the higher level as is done by Nissen and Gohrbandt, but perform a transection farther distal from the crater, as indicated by the black line [fig 53]. An important and rather delicate step is the placing of the first suture in precisely the proper spot on the very upper limit of the duodenum. This is best done if we first apply a Péan clamp to both the anterior and posterior walls of the duodenum [fig. 54]. The clamps are then rotated so that the mucosa is inverted, and when the suture is tied it will bring serous surfaces in apposition [fig 55]. This is otherwise difficult to accomplish, especially if there is only a little of the posterior wall available. After the first two interrupted

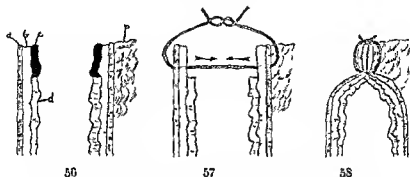
sutures have been tied, the Péan clamps are similarly applied to either the cephalic or the caudal portion of the same segment, in the same plane. After one or two inverting sutures have been applied, it is relatively easy to complete the first row of inversion sutures without the further use of clamps. The second row of inversion sutures unites the proximal ulcer margin and the anterior duodenal wall; the third row unites the thickened pancreatic capsule and the anterior duodenal wall, following Nissen's technic. Adjacent mesentery may be stitched over all, but this is not essential."

Koch states that after his adoption of the procedure outlined above, no leakage or fistulas developed in 200 cases of duodenal resection. He also stresses the fact that among these 200 cases there were many in which he would previously have used either gastro-enterostomy or the Finsterer palliative operation. He also says: "With methods previously used we could never be certain at the beginning of an operation whether it would be possible to make a permanent closure of the duodenal stump. The present technic has convinced us of its dependability and relieved us of all doubt on this score."

In my own opinion, the permanent closures achieved in Koch's cases resulted from the technic of placing the second and third rows of sutures rather than from the position of the first row.

Another method occasionally cited is that sponsored by Pauchet and Hustinx, for coping with cases in which there is only little duodenum available for plastic work. In order to reduce the thickness of the duodenal wall so as to permit of inversion without resulting tension, a cylinder of mucous membrane is excised just distal to the lower margin of the crater. I have not seen any further reports on the use of this modification (figs. 59-63). It seems questionable whether the separable mucosa would ever be long enough to secure the result intended, especially since the induration surrounding the ulcer usually binds the mucosa to the underlying duodenal wall. The basic idea, however, is a good one.

In 1942 R. McNealy published a procedure quite similar to those described above (figs. 64-67). The only difference is that he leaves the ulcer undisturbed, using for closure the posterior mucosal line proximal to the ulcer. The ulcer therefore remains within the lumen of the duodenal stump. In bleeding ulcer he



FIGS. 56-58 CLOSURE OF DUODENAL STUMP AFTER EXCISION OF MUCOSA MEMBRANE (AFTER PAUCHET)

Fig. 56 a = muscularis b = submucosa c = mucous membrane to be removed d = mucosa p = pancreas

Fig. 57. A single line of interrupted silk sutures approximates the posterior and anterior walls, which are denuded of mucosa. As is evident, the posterior wall is not separated from the pancreas. The suture therefore traverses the pancreatic capsule.

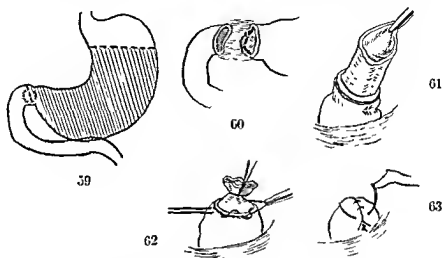
Fig. 58 Final result of closure. (Since there is no inversion of the anterior wall, the reliability of the suture may be in doubt. Apparently the technique was changed, as is evident from subsequent diagrams of Pauchet and Hustinx.)

(From Chaton, M., and Stern, W. *Tactique opératoire gastro-duodénale*)

adds, regardless of the type of duodenal closure, a plication of the anterior wall of the duodenum, in order to form an anterior wall tampon that pushes into the ulcer.

The method of atypical duodenal closure has invoked criticism from various points of view. It has come to be regarded as a fundamental precept of gastro-intestinal surgery that all incisions must be protected or covered by sutures uniting two

serous coats, and it appears rash to many to forego this principle of technic, especially when we are concerned with the most serious problem of gastroduodenal resection, namely, duodenal closure.



FIGS. 59-63. PALCHET-HUSTINX METHOD OF ATYPICAL DUODENAL CLOSURE IN DEEP PENETRATING DUODENAL ULCER

Fig. 59. Extent of resection (shown by dotted lines).

Fig. 60. Division of the duodenum is performed in such a way that the ulcer remains on the proximal segment, because it is essential for this procedure that a small cuff of normal posterior wall be exposed.

Fig. 61. Dissection of mucosal cylinder providing, after resection of mucosa, less material to turn in for subsequent duodenal closure.

Fig. 62. The cylinder of mucosa is tied at its base and the redundant portion excised. A seromuscular purse string suture is applied at the cut edge.

Fig. 63. Interrupted seroserous suture.

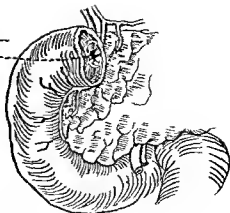
(This procedure is apparently applicable only in very small penetrating ulcers.)

(After Gararotche, I.: *Semana méd.* 49: 166, 1942)

Except for Finsterer, critics unfavorable to the method have usually based their objections on more or less general theoretic considerations. This applies to statements made by Fromme, although he does not report any personal experiences. Gulecke

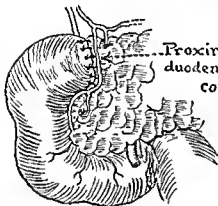
Penetrating ulcer—
posterior wall ———

64



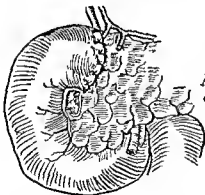
Proximity of gastro-
duodenal art. and
common duct

65



66

Ample closure involves
common duct



FIGS 64-66. PROBLEMS AND ACCIDENTS COMMON IN CLOSURE OF DUODENAL STUMP (ACCORDING TO McNEALY)

These drawings demonstrate the danger of including the common duct and gastroduodenal artery in the closing sutures when the posterior wall ulcer is resected in typical fashion

remarks that our atypical duodenal closure could be applied to certain cases, but that he prefers the Finsterer operation in others.

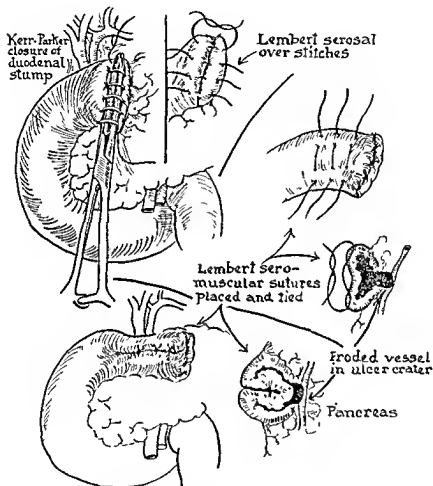


FIG. 67. McNEALY'S METHOD OF DUODENAL TAMPONADE

This technic, leaving the ulcer in situ and within the duodenal lumen, provides a form of anterior wall tampon pushing into the ulcer by plication of the anterior wall of the duodenum.

(From McNealy, R.: *Surgery* 12: 207, 1942. *Courtesy Surgery*)

Finsterer, who did use our method in some cases (he does not state in how many), maintains that it cannot be applied when the diameter of the ulcer exceeds half the width of the duodenum. However, those of us who have used the technic quite extensively have not found that any such limitation applies in actual practice. The case described by Finsterer in which a fatal outcome was due to duodenal leakage secondary to pancreatic juice digestion has previously been mentioned.

Ulrichs once observed onset of glucosuria several weeks after operation, and held that the diabetes was caused by the operative technic. This conclusion is scarcely tenable, however.

I have been unable to find additional critical reports, but it is probable, in view of the volume of the literature on the subject of surgical treatment of duodenal ulcers, that some have escaped me.

It is fair, I think, to answer the theoretic objections with the fact that many hundreds of operations have now been performed with this technic, and that occurrence of postoperative duodenal leakage has been no more frequent—perhaps even less frequent—than it is when standard procedures are used in the case of uncomplicated ulcers.

Experience shows that one can confidently depend upon the stability of the sutures as placed by this atypical method. That insecure feeling, which, as it has been expressed, "does not let one sleep in peace," has been happily absent.

In the early, more or less experimental period, we took the precaution of either leaving a drain in place near the stump, or performing a supplementary entero-anastomosis to act as a safety valve should back pressure threaten the duodenal closure. Later on, certainly since 1937, such measures have almost invariably been unnecessary.

Recently Colp and Druckerman have again brought up the question of the desirability of performing a *jejunostomy* after every extensive resection, in order to put the stomach at rest for a short time following operation. This suggestion was first made in the early days of gastric resection, but has never found

favor, although it was warmly endorsed by Lamériis and later by Kirschner. But Kirschner himself apparently abandoned the supplementary jejunostomy; two years after the recommendation, no mention of it is made in his textbook on operative surgery. Since the technic of resection has been perfected, jejunostomy as a routine measure has certainly become unnecessary. In our opinion, the additional risks of this maneuver, slight though they may be, are not justified by the slight advantage to be gained. Its use should be restricted to cases in which the stability of the gastro-intestinal suture lines is in doubt—for instance, when the esophagus is implanted into the distal gastric remnant after resection of the upper half of the stomach, or when, after total gastrectomy, esophagojejunostomy or esophagoduodenostomy is performed. Supplementary jejunostomy may also be indicated, according to McKittrick, Moore, and Warren, in patients with diabetes mellitus and “in those whose nutritional status is exceptionally poor and where immediate jejunal feedings are indicated.”

A difficult problem must be met when, in a case of penetrating ulcer of the posterior wall, *too much of the anterior wall has been excised*, leaving too short a residual duodenum and thus preventing satisfactory inversion for stump closure (fig. 10.) As previously noted, we make it a point to estimate carefully the available length of the anterior wall after it has been freed of adhesions, and we do this at the outset of every duodenal resection. But if missteps are made, owing either to a too radical plan or to a miscalculation resulting in removal of too much tissue, the surgeon is faced with one of the most difficult situations in the field of gastric surgery. For the duodenal lumen obviously cannot be sealed without undue tension upon the sutures, and the added security gained by covering the suture line with adhesions and mesentery is a very doubtful one indeed.

It must be emphasized that tension on even a single suture may bring on duodenal leakage, with its attendant serious and often fatal complications. Once such leakage has developed,

efforts at drainage, or attempts to extraperitonealize the duodenal stump through the abdominal wall, are unlikely to be effective as countermeasures.

The experienced surgeon will know how to prevent the development of this dilemma. But as things are, such embarrassing situations will occasionally have to be dealt with. The rare occasion for an obligatory very wide resection is presented when a carcinoma of the pylorus has involved the duodenum as well, so that here also satisfactory inversion would be impossible. The technic we are about to describe has been successfully used in solving such problems.

The *procedure* is based on the self-evident observation that the area of serosa-covered tissue required for a duodenal stump inversion is larger than would be needed for an anastomosis, and that the maneuver demanding least tension on the sutures must be the safest.

As the first step, the distal end of the transected duodenum is united to the first jejunal loop brought up behind the colon, in an end to side anastomosis. Thus the jejunal wall will cover the ulcer niche, either in the pancreas or the hepatoduodenal ligament. A generous length of jejunal wall near its mesenteric attachment is joined to the entire width of the proximal margin of the ulcer by means of interrupted sutures. Next, the jejunal loop is incised lengthwise, the incision corresponding to the width of the duodenal lumen and of the ulcer crater as well, so that the wall of the gut will adapt itself without tension to the base of the ulcer. The next row of sutures attaches the mesial edge of this incision to the distal margin of the crater and to the posterior duodenal wall. The third row of sutures effects the anastomosis by uniting the other edge of the incision and the free border of the anterior duodenal wall. A fourth row connects the peritoneum over the jejunal wall with the peritoneum covering the remaining narrow strip of anterior duodenal wall.

This procedure insures free drainage of duodenal contents into the jejunum, thus preventing subsequent duodenal leak-

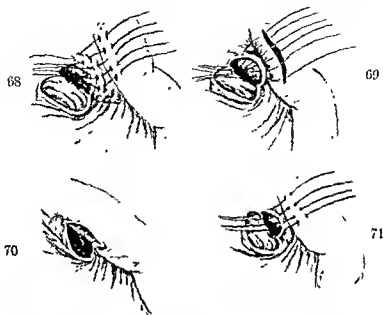
age. Its worth was demonstrated in 4 cases of duodenal resection for ulcer in which errors in the original plan of operation had led to difficulties, and in 1 case of resection for carcinoma. In 1 case the crater was too large to be completely covered by the available jejunal wall, and we filled in with a strip of omentum tailored to size and stitched to the jejunal peritoneum.

The details of this technic are shown in figures 68 to 76. It will be noted that an entero-anastomosis was always added close to the ligament of Treitz. The final steps followed the Billroth II-Polya method, using the same loop of jejunum to effect the gastrojejunostomy. These cases were watched for three years after operation, and no untoward symptoms appeared during that period. The patient with malignancy died at home after about two years, and we were unable to obtain any medical data.

As to the so-called *Billroth I technic*, although it is of great value in many of the less difficult ulcer situations, it has not found general acceptance when *resection of a duodenal ulcer* is indicated, for the following reasons: first, it is said to permit only a limited and usually inadequate resection of the stomach; second, the only dependable suture technic that allegedly can be applied is apt to result in too narrow a gastroduodenal anastomosis because of the discrepancy in the circumferences of the sectioned portions.

In this country it was Lewisohn who earliest endorsed the Billroth I method, giving credit to von Haberer for the technical details, which are well shown in his illustrations. There can be no doubt that from the standpoint of postoperative gastric function, this method of uniting stomach and duodenum is superior to any other. One reason lies in the spontaneous postoperative development of a sphincter mechanism in the region of the anastomosis. This obviates the type of projectile peristalsis that often causes unpleasant symptoms after gastroenterostomy. Another advantage is the shorter time required for performing this operation. We employ it regularly for un-

complicated duodenal ulcers of the nonperforating type, reserving the right to change the technic if the posterior duodenal



FIGS 68-71 DUODENOJEJUNAL ANASTOMOSES WHEN NOT ENOUGH ANTERIOR WALL IS AVAILABLE FOR ATYPICAL CLOSURE

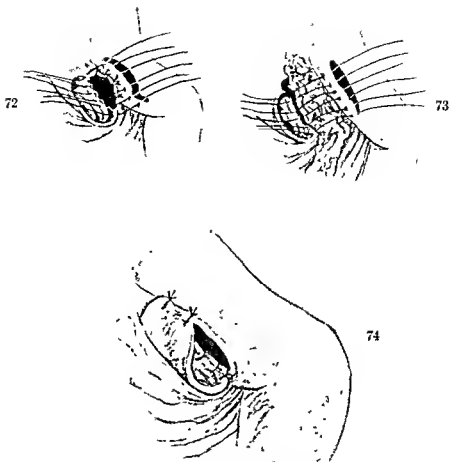
Fig 68. Interrupted seromuscular sutures through jejunum and capsule of pancreas

Fig 69 Longitudinal incision in antimesenteric border of jejunum. Interrupted full thickness sutures through proximal border of jejunal incision and proximal edge of ulcer crater

Fig 70 Interrupted full thickness sutures through distal margin of jejunal incision and anterior wall of duodenum, reinforced anteriorly by layer of interrupted seromuscular sutures

Fig 71. Alternate method of anastomosis with exclusion of ulcer. Interrupted seromuscular sutures between jejunum and proximal edge of ulcer crater

wall is too greatly indurated to allow of safe dissection. Certain technical short-cuts will be described and are shown by illustrations.



FIGS. 72-74. DUODENOJEJUNAL ANASTOMOSIS WHEN NOT ENOUGH ANTERIOR WALL IS AVAILABLE FOR ATYPICAL CLOSURE

Fig. 72. Incision of jejunum on antimesenteric border. Interrupted full thickness sutures between proximal margin of jejunal incision and distal edge of ulcer crater. When the ulcer is very large, the anastomosis is so planned that enough jejunal wall is available between the first and second suture layers to cover the ulcer crater.

Fig. 73. Before the sutures are tied, a tab of omentum is brought up under them to cover the ulcer; it is held in place by a few tacking sutures.

Fig. 74. Closure of anterior wall by interrupted sutures, reinforced by another layer of interrupted silk sutures

It should first be emphasized, however, that there are three definite contra-indications to use of this procedure:

1. A hypertrophied stomach wall, which would tend to constrict the anastomosis.

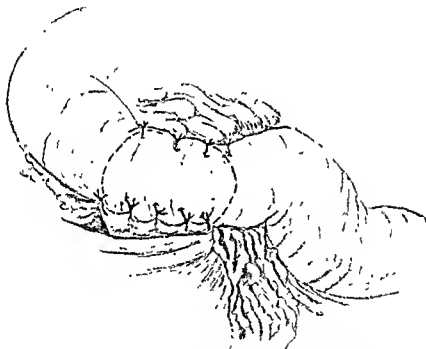


FIG. 75 DUODENOJEJUNAL ANASTOMOSIS WHEN NOT ENOUGH ANTERIOR WALL IS AVAILABLE FOR ATYPICAL CLOSURE. END RESULT

2. A duodenal lumen that is too narrow, although this is rarely found if the ulcer has been present for some time. On the contrary, when there has been extensive ulceration, the part of the duodenum distal to the lesion is often found to be actually dilated; this is analo-

gous to the dilatation of the rectal ampulla found in the presence of carcinoma of the upper rectum. It may be that in both instances this atonic condition results from the interference with peristalsis due to the ulceration.

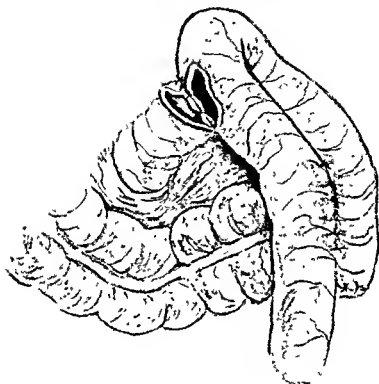


FIG. 76. ENTERO-ANASTOMOSIS TO TAKE STRAIN OFF DUODENOJEJUNO-ANASTOMOSIS

3. Very marked obesity in the patient. If all fat is carefully excised from the operative field, too much peritoneum is likely to be lost with it. On the other hand, if the fat is not removed, its inclusion in the invagination is likely to narrow the anastomotic aperture unduly, as in the case of a hypertrophied stomach.

As mentioned previously, the statement has been made that the Billroth I method does not permit a sufficiently extensive gastric resection. But as regards the majority of cases this is not in accord with the facts. Every surgeon knows that the cardia and pylorus are closer together than they appear to be on the textbook anatomy chart. In the ulcer patient, who is usually thin, both are rather freely movable.



FIG. 77. OUR PREFERRED TYPE OF GASTROEJUNOSTOMY—TOTALIS ORALIS (POLYA)—AFTER GASTRIC RESECTION

Interrupted line of Lembert sutures on posterior wall

After resection of two-thirds of the stomach, the reuniting sutures will very rarely be under any tension. All mesogastric fatty tissue along the lesser curvature should be completely removed. This is facilitated if, after section of the gastrohepatic omentum, one stretches out these tissues by tensing the primary ligature (fig 82). The blood vessels are thus straightened out, and may be readily ligated close to the gastric wall (fig 82). The union of the two segments of stomach proceeds along the lines of von Haberer's technic, as shown in figures 81 to 87. The submucous ligatures are placed with wide bite, and effectively reduce the gastric lumen to the desired degree.

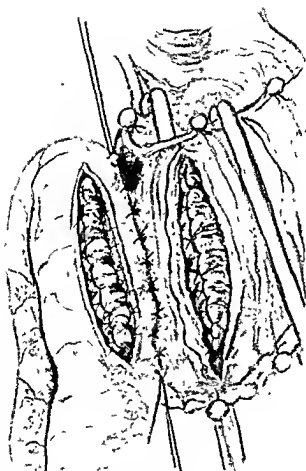


FIG 78. OUR PREFERRED TYPE OF GASTROJEJUNOSTOMY—TOTALIS ORALIS (POLYA)—AFTER GASTRIC RESECTION

After incision of the serosa and muscularis, the vessels of the submucosa are secured by interrupted catgut sutures taking bites of the submucosa. On the jejunum, these ligatures are placed in two rows; on the stomach, they are placed only on the proximal border

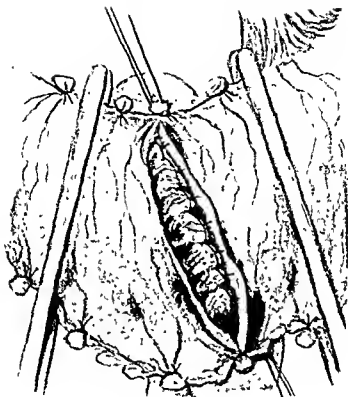


FIG 79 OUR PREFERRED TYPE OF GASTRODUODENOSTOMY—TOTALIS ORALIS (POLYA)—AFTER GASTRIC RESECTION

The stomach is turned back so that the anterior wall can be incised in the line of the posterior incision. The submucous vessels are similarly secured with ligatures. Thereupon, excision of the stomach distal to the submucous ligatures is performed.

The individual steps of the anastomosis are as follows:

1. Single sutures are inserted, but left untied, between the peritonealized surfaces of the posterior gastric and the posterior duodenal wall. The spacing of these will depend on the relation in size of the distal stomach segment and the duode-

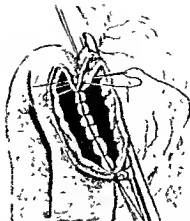


FIG. 80. OUR PREFERRED TYPE OF GASTROJEJUNOSTOMY—TOTALIS ORALIS (POLYA)—AFTER GASTRIC RESECTION

Continuous full thickness catgut suture approximates posterior and anterior cut edges of anastomosis. This layer is reinforced by a line of interrupted Lembert sutures.

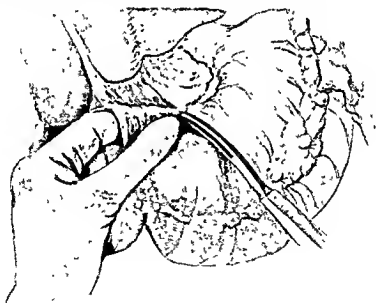


FIG. 81. BILLROTH I TECHNIC (VON HABERER'S MODIFICATION)

In order to strip the lesser curvature of all fatty tissue, it is necessary to locate exactly the junction of the gastrohepatic ligament and stomach. This is done by introducing the forefinger into the lesser sac and palpating the edge of the lesser curvature between the stomach and forefinger so that the Kocher dissector can be inserted.

num. In figure 83 it is shown as about 2:1. It is best not to apply an intestinal clamp to the duodenum, as this takes up space useful for ligatures on the posterior duodenal wall.

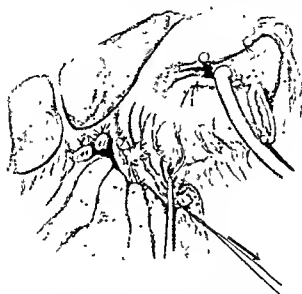


FIG 82 BILLROTH I TECHNIC (VON HABERER'S MODIFICATION)

The first portion of the duodenum has been divided, the pylorus is pulled to the left, the left gastric vessels have been tied, and the gastrohepatic ligament has been sectioned. A ligature on the distal portion of the gastrohepatic ligament is pulled taut, bringing into view the vessels of the ligament leading into the stomach. These are then tied individually and the gastrohepatic ligament is dissected carefully from the stomach. This removes all fatty tissue from the lesser curvature at the site of the future anastomosis.

2. The posterior gastric wall is incised down to the submucosa. There is usually very little accompanying bleeding. Submucous ligatures, the size of the bite depending on the relative lengths of the resection incisions as planned, are then placed in the posterior wall (fig 83).

3. The stomach is turned over and the anterior wall incised to the submucosa, at the same level as that of the posterior wall

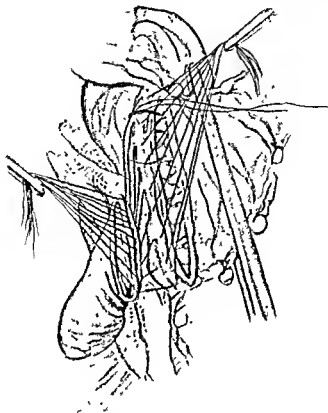


FIG. 83 BILLROTH I TECHNIC (VON HABERER'S MODIFICATION)

The posterior walls of the stomach and duodenum at the site of the future anastomosis are brought together by seromuscular sutures of silk, which are not tied. The posterior wall of the stomach is incised down to the submucous layer, bringing into view the submucous vessels. These are ligated by means of suture ligatures placed with big bites in order to diminish the circumference of the gastric lumen.

incision. Ligatures are placed in the same manner as those applied in the posterior wall (fig. 84).

4. The mucosa of the anterior wall and that of the posterior wall are next incised.

5. The peritoneal surfaces of the posterior wall of the stomach and the duodenum are then united by tying of the previously placed sutures (fig. 85).

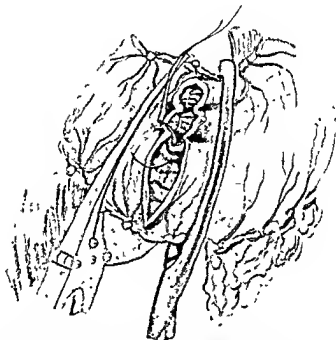


FIG. 84. BILLROTH I TECHNIC (VON HABERER'S MODIFICATION)

Suture ligatures taking large bites are carried through the mucosal and submucosal layers of the anterior wall

6. A continuous inner suture and sero-serous sutures of the anterior wall complete the anastomosis (fig. 86)

A similar technic of submucosal hemostasis is followed in the Billroth II gastrojejunostomy (figs. 77-80).

At the so-called *Jammerecke* (the critical angle), there is

placed a suture that inverts the lesser curvature slightly and includes the hepatoduodenal ligament (fig. 86). The opening that remains in the gastrocolic ligament is closed by sutures. We consider it unnecessary to cover over the seromuscular

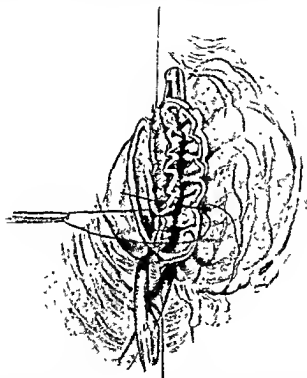


FIG 85. BILLROTH I TECHNIC (VON HABERER'S MODIFICATION)

After tying of the posterior layer of seromuscular sutures, the stomach is transected and the inner continuous suture, including all layers, is taken through the stomach and duodenum

suture line with omentum. In fact, this might cause stricture later on, owing to shrinkage.

It is rather generally held that an omental covering does reinforce the suture line, but this is open to question. Certainly, if it covers a faulty suture, the added security is more apparent

than real. The omental tissue readily becomes necrotic if infection reaches it from the gastric or intestinal wall, and in that case its presence adds to the danger.

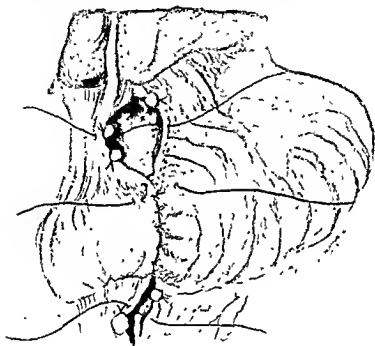


FIG. 86 BILLROTH I TECHNIC (VON HABERER'S MODIFICATION)

The outer layer of seromuscular interrupted silk sutures has been placed. A mattress suture is then taken through the duodenum, duodenohepatic ligament, gastrohepatic ligament, and stomach, thus reinforcing the critical angle. The rents in the ligaments above and below the anastomosis are closed.

A further contra-indication to the use of the Billroth I method applies in regard to penetrating ulcers of the posterior wall. In 2 cases in which we reoperated, the surgeon had used the Bill-

roth I suture procedure after wide gastric resection, leaving the ulcer crater in place. The posterior sutures took in a good deal of the thickened pancreatic capsule, and in consequence the ulcer crater remained exposed in the duodenum (fig. 87). The

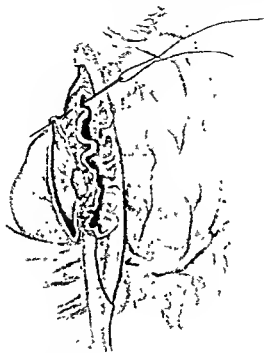


FIG. 87. BILLROTH I TECHNIC (VON HABERER'S MODIFICATION)

The ulcer is included in the anastomosis. This is technically feasible but in some instances does not cure the ulcer, as evidenced in 2 reoperated cases

ulcer symptoms continued without let-up, and soon necessitated further operation. Large indurated ulcers were found in both patients.

These observations, by the way, give ground for argument against applying a palliative fundus resection, as recommended by Connell, in the treatment of such ulcers.

II

Jejunal Peptic Ulcer

GENERAL CONSIDERATIONS

EXCEPT for possible complications of the immediate post-operative period, jejunal ulcer is the most serious mischance that can eventually occur, for it is more troublesome and more dangerous in many cases than was the primary disease. In fact, the value of a given surgical technic must be measured by the frequency with which it is followed by development of marginal ulcer.

In 1899, eighteen years after Wölfler performed the first gastroenterostomy, H. Braun first described the jejunal ulcer, and since then many publications on gastro-intestinal surgery have dealt with the topic. In the forty-six years from 1899 to the present day, in many thousands of operations, numerous different methods have been employed for surgical treatment of gastroduodenal ulcer. But there is no unanimity as to the percentage of incidence of jejunal ulcer following any given procedure, in fact, there is often wide divergence of figures. For instance, Balfour in 1927 reported the complication after *gastroenterostomy* in 2 per cent of cases, the Russian surgeon Bogoslavski in 1934, in 66.6 per cent. Obviously all statistics dealing with this complex subject should be critically evaluated. One important factor to be considered is that of differences in the periods of time covered by the observations, as evidenced in many of the reports over the past twenty years. To cite a recent example, Hinton and Church in 1934 reported occurrence of jejunal ulcers in 16 per cent of their cases during a four and one-half year follow-up. In 1940, after a seven year follow-up, an incidence of 24 per cent had been found. The general belief

seems to be that jejunal ulcers develop relatively soon after operation, and Lahey states that they are rarely found more than two years after operation. In our own material, however, among 73 cases, 51 patients developed their symptoms between the second and the fifth year after operation; in 2 cases, they did not appear until fifteen years later.

The difficulty of correctly diagnosing the condition is another factor contributing to statistical error. Symptoms and signs that have been singled out as typical are: onset of pain soon after eating, in contrast to its delayed occurrence in duodenal ulcer; localization of pain under the left costal arch, absence of the periodicity of pain characteristic of gastroduodenal ulcers; reappearance of "ulcer constipation," heartburn, vomiting, and, in rare instances, bleeding. But all these symptoms may be absent; three of our patients had had no symptoms between the time of the first operation and the sudden perforation for which they were admitted to the clinic. Negative X-ray or gastroscopic examinations do not rule out the possible presence of a marginal ulcer.

Those symptoms following gastro-enterostomy that are so frequently attributed to gastritis or adhesions are often due to the presence of a marginal ulcer for which objective diagnostic evidence is lacking. Modern methods and tests permit of more accurate diagnosis than was formerly possible, and this may in part account for the increased figures of incidence of the condition in the more recent statistics.

Another point to be considered is the fact that formerly gastro-enterostomies were sometimes performed in the absence of positive evidence of ulcer. Spasm of the pylorus or the thickened duodenal wall may be mistaken for ulcer. Thus it is probable that some nonulcer cases were included in the earlier statistics. Such patients would have normal or subacid gastric juice, and often develop troublesome symptoms, so that the term "gastro-enterostomy disease" has been applied to their condition. These patients, however, very rarely if ever de-

velop marginal ulcer, and their inclusion in the earlier statistics obviously diminished the true percentage.¹

The rule that peptic ulcers are accompanied by hyperacidity applies to jejunal just as it does to duodenal lesions. Since fractional gastric analyses have come into regular use, no case of ours has shown anacidity or even subacidity.

In Europe for the past twenty years resection has been preferred to gastro-enterostomy whenever possible, because of the frequency with which the latter was followed by marginal ulcer. In this country, however, A. A. Berg and Lewisohn were almost the only advocates of this position for quite a long period. During the past few years most surgeons have come to recognize that the rationale of their endorsement of the more radical methods has been fully established.

Of course it is true that resection does not prevent marginal ulcer in all cases, it approaches but does not reach the ideal of 100 per cent protection. As a matter of fact, in recent comprehensive statistical reports of resected cases, Mage named 8 per cent and Kiefer of the Lahey Clinic 7 per cent as the ratio in which marginal ulcers occurred. These figures are high enough to serve as an argument against resection, unless a critical analysis should demonstrate mitigating considerations.

In statistics from European sources, the rate of incidence of marginal ulcer following resections is much lower. Von Haberer reports a rate of 0.6 per cent, and Starlinger of 0.9 per cent in 7,789 cases in which the Billroth I operation was used, 2.2 per cent in 138 cases treated by the Billroth II method but without accompanying entero-anastomosis, and 0.5 per cent in 2,492 cases in which the Billroth II procedure was supplemented with Braun's type of entero-anastomosis.

¹ Some advocates of gastro-enterostomy have maintained that it is unwise to perform the operation if the presence of ulcer cannot be definitely established, because it is in these very cases that marginal ulcer is apt to develop later on. This is certainly contrary to our own experience. A gastro-enterostomy performed on a normal or subacid stomach may give rise to many disturbing symptoms, but surely not to a marginal ulcer.

Proper evaluation of the significance in a given case of marginal ulcer after resection is *difficult* unless we know (1) whether the pylorus and the ulcer were both removed, (2) how near to the cardia the upper incision was, (3) whether the resection had been preceded by an earlier gastric operation. The size of the area resected, as already remarked, is of some consequence in relation to possible postoperative complications, including marginal ulcer. But we can get only a rough idea of this from the usual reports stating that one-half, two-thirds, or four-fifths of the stomach was removed. Hence it is difficult to judge how great a part this factor plays in the results of individual surgeons.

We can reach more direct conclusions as to the relation of the typical Finsterer operation (or resection by exclusion) to the jejunal ulcer problem. In this procedure the practice is to leave the pylorus in place, and also, in order to provide adequate tissue for inversion, the adjacent portion of the antrum. The experience of von Haberer, Ogilvy, and ourselves, among others, has shown the percentage of secondary marginal ulcers occurring after this operation to be just as high as after gastro-enterostomy. This fact has been emphatically confirmed in a recent report by Kiefer from the Lahey Clinic, in which he discusses 30 cases subjected to the Finsterer operation. Seven of these developed jejunal ulcers—a percentage of 23.3. Kiefer concludes that this demonstrates the inadequacy of any technic that does not include removal of both pylorus and duodenal ulcer.

It is interesting to speculate upon what degree of responsibility for such a high incidence may be attributed to the fact that the mucosa of the antrum remains intact. On the basis of Ivy's demonstration of the secretory stimuli carried from the antrum to the glands of the fundus via the blood, excision of the antrum mucosa might be expected to improve the results. However, there is no convincing evidence in the literature that cases so treated did better in the long run, in so far as

jejunal ulcer is concerned, than cases treated by the usual Finsterer technic.

Apparently Finsterer himself found little value in the maneuver, for he discontinued its use after a period of trial. There is also the definite possibility that the residual pyloric muscle may itself become the site of origin of stimuli affecting the secretion of the glands of the fundus.

It was no doubt these considerations and his practical experience that caused von Haberer to affirm that in each case in which the Finsterer technic has been used, and reoperation for a marginal ulcer is required, *resection of the pylorus* is absolutely essential.

A typical case history (first reported in 1932) from our own material illustrates a number of pertinent features. A 52-year-old man underwent a posterior gastro-enterostomy for callous duodenal ulcer in 1926. He remained free of symptoms for six months. Recurrence of pain then led to his readmission, and the diagnosis on the basis of X-ray and clinical study was that of jejunal ulcer. At operation, a very large marginal ulcer was found, extensively involving the jejunum, stomach wall, mesocolon, and jejunal mesentery. The previous anastomosis was eliminated, the opening in the stomach wall closed, and the ulcer-bearing part of the small intestine resected, with end to end union. No symptoms appeared for another six months; then again there was recurrence of pain characteristic of duodenal ulcer. At operation (1929), a large, callous, deeply penetrating duodenal ulcer, involving the pancreas, common duct, and hepatoduodenal ligament, was found. Prepyloric section of the stomach was performed, followed by a widespread resection of palliative type, with final union by the Polya technic. After another half-year there was again evidence of jejunal ulcer. Reoperation revealed a very large ulcer in the upper segment of the anastomosis, between the stomach and the jejunum. Almost the entire gastric remnant was ulcerated.

Resection was not attempted, as it appeared technically impossible. The pylorus was excised; the duodenal ulcer was found to be healed. Jejunostomy was performed to put the stomach at rest. The postoperative course was satisfactory, the jejunostomy tube was removed after three weeks, and complete recovery followed. In an observation period of four and a half years, there was no evidence of further ulceration²

Another modification of the palliative resection, namely, transection of the duodenum distal to the pylorus (Zuk-schwerdt), was designed in the hope that the improved results would equal the results after radical resection. The technic would then be practically identical with the radical resection procedure, except for the fact that a diseased posterior wall is united to an insufficiently mobilized anterior wall. It would seem rather more logical to go all the way, by taking the additional and more dependable step of duodenal resection.

Further comment may be made at this point regarding those jejunal ulcers that develop even when *radical resections* have been performed. The figures of their incidence vary considerably in the statistics from different clinics, as pointed out above, but in any case they must be reckoned with as spoiling

² paper of L. S. McKittrick, F. D. Moore, and R. Warren, published when this book was in process of being printed, reports 7 cases of jejunal ulcer after exclusion resection in which cure of the ulcer was obtained by antral and pyloric excision. On the basis of these, together with 2 cases of S. F. Marshall of the Lshey Clinic, the authors conclude that antral excision as a method of treatment of jejunal peptic ulcer after exclusion resection has been successfully performed in 9 cases. Our cases, one of which is described above, were published in 1932 and 1936. Von Haberer, in discussing the exclusion resection, reported similar experiences with antral and pyloric excision much earlier. It is interesting that McKittrick, Moore, and Warren recommend a two stage procedure as the operation of choice for resection of "acutely inflamed" duodenal ulcers, particularly those of the posterior wall. The first stage consists of transection of the stomach, the second of excision of the excluded part of the stomach. The reason for adopting this procedure was the high mortality rate (8 per cent) of resection for duodenal ulcer. It may be argued that while the typical technic of duodenal closure in this particular kind of duodenal ulcer is too hazardous, our technic is dependable enough to make a two stage procedure superfluous.

the end results in a certain number of cases. The fact that a higher percentage is reported in this country (Mage) than in Europe merits special attention, because the clinical follow-up is more thorough in North America. However, of the total of Mage's 41 cases of jejunal ulcer, only 13 were verified at operation. Among the cases operated on were 2 in which no ulcers were discovered—"the surgical findings were considered to be those of healed lesions." However, in the absence of histologic examination, the nature of these lesions remains obscure. Kiefer has been more rigid in analyzing his cases, and included in his classification only those proved to have marginal ulcer at the time of resection. Interpretation of Mage's statistics must also be qualified by the fact that his 60 cases were observed during a seventeen year period (1923-1940). The conception of gastric resection for ulcer, especially with regard to the size of the resection, underwent important changes in this interval. The rather essential information as to the extent of the resection in each case is lacking, and another variable is the fact that various surgeons were concerned.

There are cases of recurrence of the ulcer disease, regardless of the type or size of resection performed. They have been termed *surgically intractable*, and in truth they are no less intractable medically. According to our experience these are usually cases in which the first operation for duodenal ulcer—the condition is practically never found in gastric ulcer—was not performed by the radical technic; in other words, the first operation was either a gastro-enterostomy or an exclusion resection. The following case history, first published in 1938, exemplifies this situation.

The patient was a 30-year-old white male, first admitted in May 1930, with a large duodenal ulcer penetrating into the pancreas. An exclusion resection was followed by uneventful recovery. Four weeks later, the patient was readmitted presenting the clinical picture of ruptured ulcer. An immediate

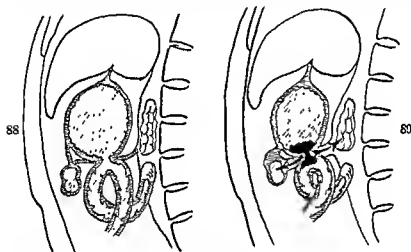
operation disclosed free perforation of a large jejunal peptic ulcer. The operation consisted in closure of the opening, removal of the antrum and pylorus, and jejunostomy. Recovery was delayed by a subphrenic abscess. The patient was discharged from the hospital four weeks after operation. His third admission was in January 1931. The diagnosis was that of jejunal peptic ulcer. At operation a large anastomotic ulcer was found. Since the ulcer had not been influenced by jejunostomy, resection was decided upon. The remainder of the stomach was removed, together with the jejunal loop, and esophagojejunostomy was performed. The patient was discharged fourteen days after operation. In February 1933 there was a fourth admission because of signs and symptoms of jejunal peptic ulcer. The X-ray picture showed a large ulcer at the esophagojejunostomy. I was not able to observe the patient's subsequent course.

Many investigations have proved that in these repeated ulcerations there is always more or less gastritis accompanying the condition of jejunal ulcer.

We cannot go into the question of the relationship of gastroduodenal ulcer disease to gastritis, but it can be asserted that Konjetzny's assumption that ulcer is secondary to gastritis is upheld by few. The converse seems more likely, especially when, as is usually the case, the mucosal inflammation is restricted to the area surrounding the ulcer. On the other hand, resection of an ulcer rarely has any favorable effect if the whole gastric mucosa is inflamed—in fact, the more intense an accompanying gastritis, the less the likelihood that the radical operation for jejunal ulcer will bring about a cure. It is probable that the presence of a prolonged and severe gastritis makes such ulcers surgically intractable, since in cases of marginal ulceration the severity of the gastritis usually progresses in proportion with the duration and degree of the symptoms. It would therefore seem a poor policy to postpone the radical operation.

ANATOMIC FEATURES

The radical operation for marginal ulcer is more hazardous than the resections performed for other conditions, chiefly for two reasons. In the first place, the general condition of these patients is usually poor by the time they come to operation; second, the anatomic relations of the structures in the field of operation have been distorted by inflammation and adhesions.



FIGS 88-89 COMMON DIRECTIONS OF PERFORATION IN JEJUNAL PEPTIC ULCER

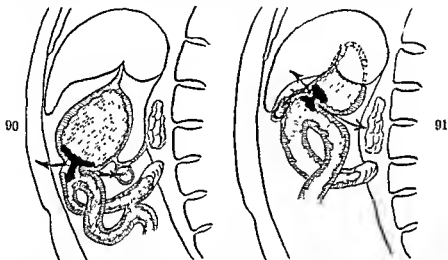
Fig 88 Schematic sagittal sections of abdomen in retrocolic anastomosis.

Fig. 89 Common directions of perforation toward colon and pancreas in retrocolic anastomosis

Consequently operation for marginal ulcer is never stereotyped, and impromptu technical maneuvers are frequently required. However, the more usual anomalies encountered, depending on the direction in which the ulcer penetrates, can be classified and described (figs 88-91)

Among the various possibilities, an ulcer located at the *anterior anastomosis* (antecolic) presents the least complicated situation, for it rarely penetrates into neighboring structures;

in fact, its tendency to rupture is no greater than that of an ulcer at the posterior anastomosis. The colon is occasionally adherent to the anastomosis, but it is only very rarely that a gastrojejuno-colic fistula develops. The usual direction of penetration is into the anterior abdominal wall (fig. 89), and we then find a firm, tender ulcer-tumor that may be quite large.



FIGS 90-91. COMMON DIRECTIONS OF PERFORATION IN JEJUNAL PEPTIC ULCER

Fig. 90 Perforation toward anterior abdominal wall, and in rare instances to colon, in antecolic anastomosis

Fig. 91. Penetration toward liver, usually left lobe, and, more rarely, toward pancreas, in marginal ulcer after gastric resection

The evidence of inflammatory changes in the surrounding tissue will be proportional to the depth of penetration into the rectus muscle. The marked swelling and redness of the abdominal wall, and the fact that palpation of the center of the mass, over the ulcer crater, may elicit fluctuation, may lead to the mistaken diagnosis of a simple abdominal wall abscess. If the mass is then incised, an external gastrojejunal fistula will result—always a precarious situation, regarding which we shall have

more to say later on. In other cases the right lobe of the liver is found to be in contact with the anastomosis, with penetration into this organ. The liver tissue surrounding the ulcer crater usually shows remarkably little inflammatory reaction, and the adhesions between the anastomosis and the liver are not dense and are readily separated. In fact, violent physical exercise may result in such a separation and a consequent free perforation.

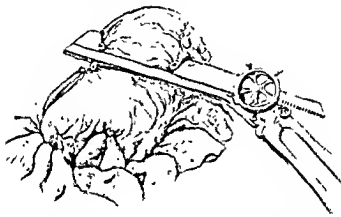


FIG. 92 TWO STAGE RADICAL OPERATION FOR GASTROJEJUNAL ULCER

Stage 1 Small corresponding segments of the greater and lesser curvatures of the stomach are devascularized and a von Petz clamp is introduced, in preparation for transection of the stomach

Occasionally the penetration is directed into the mesentery of the anastomotic jejunal loop, but this situation does not present technical difficulties.

Anatomic anomalies that are much more difficult to deal with are usually present if the jejunal ulcer involves the *posterior anastomosis* (retrocolic). Penetration into neighboring organs is very frequent, and had occurred in all of our own cases. The break-through may be into the mesocolon and thence into the colon itself, or into the mesentery of the anastomotic loop, or into the root of the mesentery, or into the pancreas, a combined

involvement of these locations is frequent (fig. 90). In the technical procedure particular attention must be directed to the



FIG. 93. TWO STAGE RADICAL OPERATION FOR GASTROJEJUNAL ULCER

Stage 1. The stomach is divided between the two rows of clips applied with the von Petz instrument. Then the cut ends of the stomach are inverted, and anterior gastro-enterostomy and short circuiting entero-anastomosis are performed. In this way the distal part of the stomach and the peptic jejunal ulcer are excluded from the food passages. The jejunal ulcer diminishes in size considerably within from three to four weeks. (Delay of the second stage beyond this length of time would invite formation of a new peptic ulcer on the gastro-enterostomy of the proximal part of the stomach)

mesocolon, which is always found to be much shrunken, owing to cicatrization. The large blood vessels in the mesocolon

either lie very close to the ulcer-tumor or actually course through it, and the technical plan of campaign must be modified accordingly, especially in respect to the dissection of the ulcer itself.

The development of a gastrocolic fistula may be a further result of contiguity of jejunal ulcer and colon. Hemorrhages (which incidentally are not as frequent in the case of jejunal as of duodenal ulcers) may originate from the mesocolic vessels; more usually they arise from eroded vessels of the jejunal mesentery.

The afferent segment of the jejunal loop is usually quite short—in fact, some surgeons make a point of having it very short—when gastro-enterostomy is performed ("no-loop gastro-enterostomy"). As the ulcer projects progressively into the jejunal mesentery, more and more of this initially short piece of intestine becomes involved in the process and thus useless for technical purposes. By further extension, the infiltration will reach the duodenojejunal junction, and finally the most distal segment of the duodenum may be walled in by inflammatory adhesions, presenting the most difficult problem to be met with in posterior wall jejunal ulcers. This will be discussed at greater length later on. The management of pancreatic penetration is similar to the procedure used when an ulcer of the posterior gastric wall has caused the same complication.

If the ulcer crater is large, the possibility of erosion of the duct of Wirsung should not be overlooked. This is an unusual finding, probably because connective tissue proliferation secondary to and accompanying the extension of the ulcer protects the duct.

The direction taken by the penetration of a jejunal ulcer after a *Bullroth II* resection or its Polya-Mayo modification will depend first on the level chosen for gastric transection, and second on whether the ulcer has developed more toward the anterior or toward the posterior wall of the gastrojejunal anastomosis. Where a retrocolic anastomosis has been per-

formed, penetration of the colon is probable (fig. 91), if the edge of the opening in the mesocolon has been sutured close to the anastomosis. Under these circumstances a gastrocolic fistula might conceivably develop, though I have found no report of any in the literature.

According to the location of the ulcer, there may be penetration either into the left lobe of the liver, into the spleen, or into the retroperitoneal space, in which case the splenic artery will be in dangerous proximity to the ulcer crater.

There is no need to include in this brief anatomic survey any discussion regarding those *jejunal ulcers*, in the strict sense of the term, that are located on the afferent or the efferent loop but at a considerable distance from the anastomosis proper. Although they too represent a positive indication for the radical operation, from the anatomic point of view they do not present any technical difficulties.

The various aspects of the surgical management of marginal ulcers, such as the question as to the most *opportune time for operation*, and the many technical problems, have produced a sizable mass of literature.

A few reports have appeared claiming satisfactory results from a prolonged regimen of *medical treatment*. Most surgeons, however, have not been favorably impressed. It is only natural for patients who suffer ulcer relapse after a first operation to resist the suggestion of further surgery. They first seek a cure by medical means, but usually without success, even as regards relief of symptoms. The prospects for medical cure in marginal ulcer are very slim indeed as compared to the outlook in gastric or duodenal ulcers. Nevertheless, many surgeons recommend that a trial of meticulous medical treatment be made, in the absence of such indications for prompt intervention as evidence of free perforation, repeated hemorrhage, or penetration into the abdominal wall. Strict dietetic and careful medical treatment and bed rest will often result in improvement but resumption of normal activities brings on renewed symp-

toms. Such observations have led to the practice of submitting patients with marginal ulcers to an extended period of medical treatment in the hospital before operation. This often results in regression of signs of perforation, or decrease in the size of the mass, thus decreasing the operative risk, and lowering the mortality rate for the radical operation.

At the same time it must be admitted that although extensive resection is the most rational technic to apply in the marginal ulcer case, the risk is materially greater than that of subtotal gastrectomy performed for gastric or duodenal ulcer. This fact has weighed heavily in the balance against favorable surgical judgment of the method.

Yet experience has proved that in cases of marginal ulcer it is only the radical technic that gives us any reasonable assurance of a permanent cure. Many attempts at cure have been made with palliative methods or with technics limited to the local lesion. One frequently used conservative procedure is that of excision of the marginal ulcer itself. The stomach and intestinal walls may then be reunited or the loops of intestine containing the ulcer may be resected and the anastomotic opening in the stomach separately closed, with or without addition of a new gastro-enterostomy. Unfortunately, none of these methods, including that of Estes (fig. 101), has proved satisfactory. Bohmansson, van Roojen, also Strauss, Bloch, and Friedmann, and Balfour have all reported to this effect, and this has also been our own experience.

It has also been suggested that the marginal ulcer should be left undisturbed and a new gastro-enterostomy performed. Healing of the original marginal ulcer does often follow, along with progressive cicatricial shrinkage of the anastomosis aperture. But after a variable period a new ulcer inevitably develops at the site of the second anastomosis (Strauss, Bloch, and Friedmann; Oehlecker; Thompson and Stewart).

Babcock is responsible for the ingenious proposal that the flow of bile be directed into the stomach, in order to neutralize the gastric juice and thus permit healing of the marginal

ulcer. However, a case reported by Walzel indicates that cholecystogastrostomy cannot be relied on to achieve the desired result. A marginal ulcer developed in his patient some time after simultaneous cholecystogastrostomy and gastro-enterostomy had been carried out, and at the second operation it was definitely demonstrated that the anastomosis between the gall-bladder and the stomach was functioning. It was remarked early in our discussion that the assumption that gastro-enterostomy would permit neutralization of the gastric by the duodenal juices could not be substantiated. Examinations showed that the intestinal juices do not consistently reduce a hyperacidity. This is equally true of alkalies given by mouth in the customary manner. In fact, intermittent administration of alkalies at times causes reactive further increase in acidity.

The most effective of the palliative methods is still that proposed by von Mikulicz-Kausch in 1899, namely, of putting the stomach and ulcer at rest by performing a jejunostomy.

Strauss, Bloch, and Friedmann, Enderlen, Laméris, and also Friedemann have shown that healing of the marginal ulcer may result, but also that a relapse promptly follows when the jejunal tube feedings are discontinued. Consequently the value of jejunostomy is limited to amelioration of the local and general condition of the patient preliminary to his undergoing a radical operation, thus lessening its difficulties and risks. Occasionally this period of preparation by jejunal feeding must be extended over two or three months. The secondary resection should be carried out as soon as the jejunal fistula has completely healed after removal of the jejunostomy tube—usually a matter of two weeks or less. A longer interval involves the risk of recurrence of the marginal ulceration.

The program of preliminary jejunostomy has various drawbacks from both practical and economic standpoints. The schedule and formulation of feedings must be organized and supervised with great care, and a rather long period of hospitalization is required, unless the patient's means permit of treatment in his home. In any case, the length of time needed for

this preliminary care militates against universal application of this measure.

TWO STAGE RESECTION

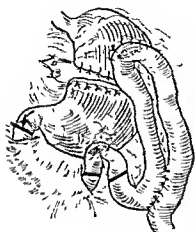
The following procedure not only provides a means of more immediate and specific preparation for the radical operation, but also puts the ulcerated area at rest. This preliminary operation consists in sealing up the upper one-third of the stomach (along the upper resection line of the radical operation) and anastomosing the resulting stomach pouch with the jejunum (fig. 94).

The individual steps are as follows: Through a left paramedian incision, the distal segment of the anastomotic jejunal loop is identified and a 50 cm. length of it brought forward. The gastrocolic and gastrohepatic ligaments are then divided by a 3 cm. incision toward the upper part of their gastric attachment. The blades of a Petz clamp are introduced through this opening in the ligaments (fig. 92) and adjusted to the stomach wall, and its double row of clips is inserted in the usual way, insuring a watertight closure (fig. 93).

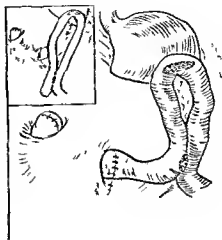
The forceful clamping destroys the mucous membrane between the two rows of clips, providing the necessary conditions for development of a fibrous septum permanently separating the stomach into a proximal and a distal portion. If the general condition of the patient is too poor to permit of a longer operation, transection may be omitted, the final step being that of covering the clamp furrow with seroserosus sutures. However, as a rule it will be expedient to undertake the transection between the two rows of clips, followed by the standard invagination of the stumps (fig. 94).^{*}

^{*} Although we have never been obliged to omit the transection in cases of marginal ulcer, it seemed desirable to do so in several cases of inoperable stenotic and ulcerated cancer of the pylorus, where sealing of the upper half of the stomach was combined with gastroenterostomy. Our purpose here was to stop the intolerable regurgitation of necrotic material. Autopsy in one such case, more than eight months after operation, revealed complete sealing off at the line of the clamp furrow, with practically all the clips still in place.

After inversion of the stumps the anastomosis is constructed between the previously withdrawn jejunal loop and the proximal stomach segment. The anterior gastric wall usually presents a larger available space for this than the posterior wall. A Polya-Mayo anastomosis is not advisable because of the narrowness of the space available between the proximal and the



94



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FIGS. 94-95. TWO STAGE RADICAL OPERATION FOR GASTROJEJUNAL ULCER

Fig. 94. Situation on completion of first stage. Lines of resection in coming second stage are marked.

Fig. 95. Condition after resection of stomach, first part of duodenum, and jejunal loop. The jejunal anastomosis can be made either end to end or (insert) end to side above the entero anastomosis established in the first stage. The latter procedure is indicated when the two jejunal openings are disparate in size.

distal portion of the stomach. In accordance with our practice in anastomoses involving a long intestinal loop, an entero-anastomosis is also performed (fig. 94).

The entire procedure takes little time, does not require extensive ligation of the mesentery, thus puts a very slight additional strain on the patient, and by means of it one step of the subsequent radical operation is completed in advance. After

three weeks, which is usually the optimum interval, the second operation is performed (fig. 95).

The preliminary operation described above always produced immediate cessation of ulcer pain, which had often been very severe, and although the ulcer itself was never found to have completely healed during the three weeks, the size of the ulcer-tumor had always diminished considerably. In the second stage (resection) it is advisable to enter the abdomen by a right paramedian incision.

RADICAL OPERATION FOR MARGINAL ULCER SECONDARY TO ANTERIOR GASTRO-ENTEROSTOMY

Local signs and symptoms in the abdominal wall such as pain, tenderness, and swelling are usually sufficient to indicate a penetration in this direction from ulcer of an anterior anastomosis. The abdominal incision is located in such a way as to open the peritoneal cavity beyond the lateral border of the mass. It is not necessary or even advisable to excise the whole mass, for the resultant loss of muscle and fascial tissues is apt to prevent satisfactory abdominal wall closure. The adhesions between the anastomosis and the abdominal wall are separated by blunt dissection until it is possible to grasp the mass with a strip of gauze and then dissect it completely free (fig. 97), leaving the ulcer crater undisturbed in the abdominal wall. The perforation opening into the anastomosis is provisionally closed with Allis clamps. Except for these steps, the procedure is identical with that of a typical resection.

Section of the afferent and efferent segments of the anastomotic loop is now undertaken (fig. 98). If it is found that a decompression entero-anastomosis was performed at the previous operation, and if it is of sufficient diameter, the distal ends may be closed. Otherwise an end to end anastomosis of the distal jejunal stumps is made (fig. 99). Standard resection of the stomach completes the operation.

If the original duodenal ulcer has, in healing, produced thick

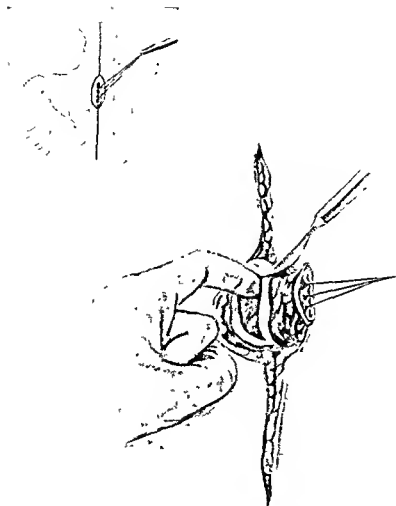


FIG 96. PROCEDURE IN PERFORATION OF ANTERIOR WALL IN JEJUNAL PEPTIC ULCER (EXTERNAL FISTULA)

Incision through all layers of abdominal wall, encircling inflammatory mass. (*Insert* shows line of abdominal incision)

scar tissue, it may be quite difficult to dissect out the duodenum adequately. In such cases, however, very marked stenosis is the rule, and if one is careful to determine the exact location of

the former lesion, it will be found that the lumen to be sectioned and closed is very small at this point.

Cauterization and, when possible, suture closure of the ulcer crater is carried out before suturing of the abdominal wall.

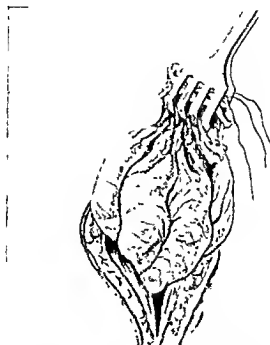


FIG 97 PROCEDURE IN PERFORATION OF ANTERIOR WALL IN JEJUNAL PEPTIC ULCER (EXTERNAL FISTULA)

The entire mass, together with the adherent gut and stomach, is eviscerated from the abdomen

If the penetration involves the lower surface of the liver, the first step here also is to separate the tumor from the organ. Because of the possibility that some of the larger bile ducts within the liver tissue may have been eroded, it is best to leave a tampon in position for a few days.

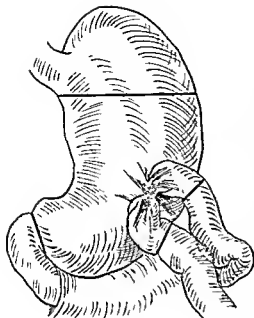


FIG. 98. PROCEDURE IN PERFORATION OF ANTERIOR WALL IN JEJUNAL PEPTIC ULCER

Extent of resection. Since there is a previously established entero-anastomosis, the cut ends of the afferent and efferent duodenal stumps may be closed

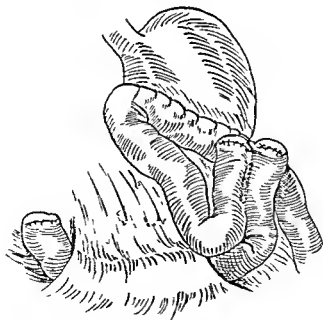


FIG. 99. PROCEDURE IN PERFORATION OF ANTERIOR WALL IN JEJUNAL PEPTIC ULCER

Final view after resection, closure, and anastomosis

If there has been complete perforation of the abdominal wall (i e., external fistula), the method used is the same as that employed for a gastric fistula of the same type. The fistulous tract is excised, this involving sacrifice of a certain amount of muscle, fascia, and peritoneum (fig. 96). If the stomach is adherent to the fistulous tract, it is usually freed without difficulty. Similar freeing of the small intestine, which is usually extensively adherent to the abdominal wall, is tedious and must be done with great care. The afferent jejunal loops should be completely visualized by extension of the incision downward if necessary.

RADICAL OPERATION FOR MARGINAL ULCER SECONDARY TO POSTERIOR GASTRO-ENTEROSTOMY

Among the various anatomic situations that we are considering, it is only in two that more than minor technical difficulties are encountered. These are (1) marginal ulcer in a posterior gastro-enterostomy anastomosis, and (2) marginal ulcer developing after gastric resection has been carried out. We shall now discuss the first of these.

In this situation, if there has not been very deep penetration, it is possible and desirable to approach the anastomosis from the anterior aspect. Free access to the anterior surface of the mesocolon is first assured by a wide division of the gastrocolic ligament. The mesocolon is then separated by blunt and sharp dissection from its attachment to the stomach and/or jejunum, as closely as possible to these organs, to avoid damage to large blood vessels. If it is then found possible to clear the whole circumference of the anastomosis, the further steps are the same as in the case of ulcer located on an anterior anastomosis (figs. 97-99). Attempt is often made to avoid resection of the anastomotic jejunal loop (fig. 100), but the lumen is usually insufficient for adequate function. The technic proposed by Lahey or Estes may prove successful in obviating jejunal loop resection (fig. 101).

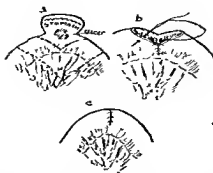


FIG. 100. LAHEY'S METHOD OF TAKING DOWN GASTRO-ENTEROSTOMY WITHOUT COMPLETE TRANSECTION OF JEJUNUM

Only a fraction of the entire circumference of the jejunal wall is removed and the mesentery remains intact. Clo-ure of such an opening into the jejunum leaves the caliber greater than it was originally.

(From Lahey, F., and Marshall, S : *Surg, Gynec & Obst* 76:641, 1943.
Permission Surgery, Gynecology and Obstetrics)

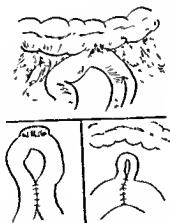


FIG. 101. ESTES OPERATION FOR DISMANTLING GASTROJEJUNAL RETROCOLIC ANASTOMOSIS IN JEJUNAL PEPTIC ULCER

There is a general agreement that this type of conservative procedure is inadequate and commonly leads to recurrence of the primary ulceration in the stomach or duodenum.

(From Estes, W. L., Jr : *Ann Surg* 96: 250, 1932.
Courtesy Annals of Surgery)

When this resection is undertaken, it is very important to sever the mesentery directly up to the intestine. Otherwise the blood supply of the remainder of the loop, especially the afferent segment, every centimeter of which is of great value, will be jeopardized. It is best to avoid the use of clamps in reuniting

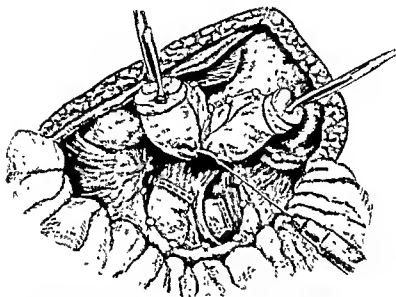


FIG 102 PROCEDURE IN PEPTIC JEJUNAL ULCER WITH JEJUNOCOLIC FISTULA

The jejunal loop has been transected proximally and distally to the ulcer and lifted upward, exposing the wall of the crater, which is opened with a diathermy needle

the afferent and efferent segments, so that one may make sure from the degree of bleeding of the cross-sectioned gut and from its surface appearance that there will be a proper blood supply.

If deep penetration has taken place, the technic is similar to that used for penetrating gastric and duodenal ulcers.

After the crater has been exposed, the adherent stomach or jejunum is separated from the ulcer margin by blunt dissection

or with scissors, knife, or diathermy needle (fig. 102). This step reduces the danger of damage to surrounding structures. As

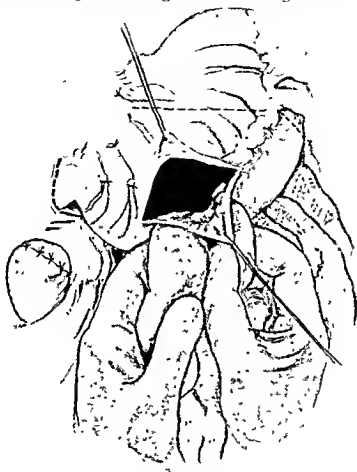


FIG. 103. GASTROJEJUNAL ULCER FOLLOWING RETROCOLIC ANASTOMOSIS

After adequate padding off of the surrounding viscera and closure of the duodenum, the devascularized stomach is opened longitudinally on the posterior wall close to the anastomosis. The ulcer is thus visualized

soon as the stomach is opened, it should be suctioned clean and plugged with gauze.

It is usually easier to open into the ulcer crater directly from without than to approach it from within the intestinal lumen.

The exploring finger, after locating the center of the ulcer, searches for the point of least density of the adhesions between the anastomosis and the penetrated viscus. These adhesions are usually more dense and impermeable, the nearer the ulcer lies to the ligament of Treitz. If they are very unyielding, an incision should be made in a clear spot on the stomach or jeju-

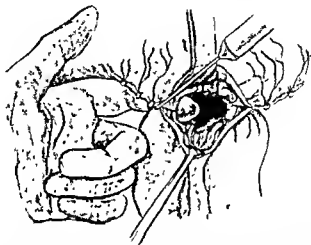


FIG. 104. GASTROJEJUNAL ULCER FOLLOWING RETROCOLIC ANASTOMOSIS

With the finger in the lesser sac, the anastomosis is pushed upward and made prominent. The anastomosis is then taken down from within under direct vision. This rather messy procedure of opening the stomach and dissecting from within is often advisable in order to avoid injury to important surrounding structures.

num near the anastomosis, the ulcer then brought into direct vision, and separation of the crater undertaken by this route (figs. 103, 104). Occasionally it is unavoidable, in the maneuvers used to free the anastomotic area, to apply rather brusque force in pushing or pulling. Within safe limits, speed is gained thereby.

The normal anatomic relations are often so much altered that large vessels cannot be identified by their position and the oper-

ator must rely on palpation. The placing of any ligatures en masse is hazardous. The middle colic artery is especially apt to be injured; if possible its course should be determined early during the operation. Excision of the ulcer crater is unnecessary, no matter in which viscus it is imbedded, nor need it be cauterized or sutured.

It is important to have available a sufficient width of the peritoneal covering of the afferent, i.e., the *proximal jejunal loop*. This will be found to be inadequate if the surgeon who performed the previous gastro-enterostomy used too short a loop or if the mesentery of this loop is scarred and shrunken. It is wise to make sure, early in the operation, that the afferent segment of the jejunal loop still covered by serosa will be long enough to permit a satisfactory end to end union with the efferent segment. Regarding this important detail, when the popular "gastrojejunostomia retrocolica verticalis" of Kocher is used, an especially unfavorable situation develops in cases of marginal ulcer, in which the duodenojejunal flexure commonly forms part of the anastomosis. It is essential here to extend the resection as far as up to this flexure (fig 105). When, as is usual, the retroperitoneal space is filled with scar tissue, proper end to end union of the jejunal stumps is likely to be impossible.

The following technic solved this problem for us in 3 such cases. The duodenal flexure was first closed off. Then, as a precautionary measure, the margins of the duodenojejunal flexure and the ligament of Treitz were sutured together. The other jejunal lumen was then invaginated, and through a slit in the mesocolon, the jejunal loop was approximated to the anterior wall of the first or second portion of the duodenum, and a side to side anastomosis was made (figs. 106, 107).

In a discussion dealing with this technic, Basset maintained that it would be simpler in such cases to mobilize the third, retroperitoneal portion of the duodenum and anastomose it with the jejunum. Clairmont worked out his "mobilization of the duodenum from the left" with the object of making the

lower segment of the duodenum accessible for anastomosis. Lahey employs a similar method (fig 108). But when, as in



FIG 103 RESECTION OF RETROCOLIC JEJUNAL PEPTIC ULCER

Step 1 Lines of resection when the afferent jejunal loop is so short that after its dissection no reliable anastomosis with the efferent loop can be performed. (Insert shows level of transection of afferent loop, coinciding with ligament of Treitz)

some marginal ulcer cases, the inflammatory infiltration extends far into the third portion of the duodenum, attempted mobilization must result in damage to the infiltrated duodenal wall

In our experience, radical treatment of these cases requires the application of some such technic as the one we have used, as described above. It should be added that the obvious way to assure normal duodenal juice drainage after the postpyloric transection of the duodenum, is to anastomose the duodenal lumen either side to end or end to end with the efferent jejunal loop, as illustrated in figures 106 and 107.

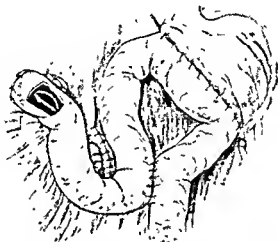


FIG. 106. RESECTION OF RETROCOLIC JEJUNAL PEPTIC ULCER IN CASE OF SHORT AFFERENT JEJUNAL LOOP

Step 2. The afferent loop is closed blind. The ligament of Treitz is closed over the stump. The efferent loop is also closed blind and then anastomosed side to side with the duodenal stump in an antecolic direction. (Fenestration shows duodenal-jejunal stoma) Though the duodenal contents must run uphill, no inconvenience was observed in cases operated in this fashion. Entero-anastomosis is performed to relieve the burden of the jejunal end

The exact condition of the primary gastric or duodenal ulcer should always be investigated. In case it is found not to be healed, it should be included in the resection; this further prolongs a long operation, especially in duodenal ulcer. One is often inclined under these circumstances to leave the

ulcer "as is," after performing prepyloric resection, in the knowledge that the problem is solved for the time being at least. But it should be realized that when a marginal ulcer has once occurred, there is always a marked tendency to relapse. The Finsterer operation in itself is very frequently followed by post-operative jejunal ulcer. It is often advisable when this method of resection has been used, to perform a subsequent operation,

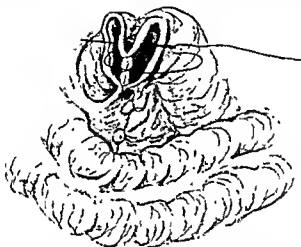


FIG 107. RESECTION OF RETROCOLIC JEJUNAL PEPTIC ULCER IN CASE OF SHORT AFFERENT JEJUNAL LOOP

Alternate procedure Instead of blind closure of the duodenal stump and efferent jejunum, a connection of their lumina is made by end to end retrocolic anastomosis

after from one to two months, for removal of the prepyloric pouch (p 96).

A cogent reason for carrying out as extensive a gastric resection as possible for marginal ulcer is the desirability of producing lowered acidity or anacidity. It should be appreciated that the inevitable gastritis found in such a stomach (p 99) is always accompanied by marked hyperacidity. Even after resection the gastritis in the residual stomach heals slowly, and sometimes does not subside.

It is immaterial whether the Billroth I or Billroth II technic is used in the further steps of the operation. But in most cases the small gastric remnant cannot be manipulated sufficiently for the application of the Billroth I procedure.

Our own experience is limited to the Billroth II method, as modified by Polya. The anterior anastomosis was always made



FIG. 108. LAHEY'S METHOD OF TRANSPOSING SHORT PROXIMAL JEJUNAL LOOP AFTER DISMANTLING OF GASTRO-ENTEROSTOMY

The parietal peritoneum about a short jejunal stump has been cut. The short stump has been inverted and is being pushed beneath the mesenteric vessels, where it can be pulled through the right mes-enteric peritoneum and anastomosed to the distal end of the jejunum.

(From Lahey, F. and Marshall, S : Surg , Gynec. & Obst 76: 641, 1943.

Permission Surgery, Gynecology and Obstetrics)

and followed by an entero-anastomosis. Although the alkaline duodenal juice is diverted from the gastrojejunostomy by the entero-anastomosis, it may be repeated that we do not believe that this is necessarily a definite disadvantage. There can be no doubt, however, that in taking the strain of possible over-distention from the duodenal stump, the entero-anastomosis serves a very useful purpose.

A protracted period of *atony of the gastric remnant* and the anastomotic loop often follows the operation for marginal ulcer. This is attributable to the repeated manipulations as well as to prolonged anesthesia, whether general or continuous spinal. Fluoroscopic examination has shown no perceptible peristalsis in the overdistended gastric remnant, or in the equally distended first jejunal loop, for as long as sixteen days after operation. This warrants a supplementary *jejunostomy* in these cases, so that oral feeding may be omitted for the first three weeks.

RADICAL OPERATION FOR MARGINAL ULCER FOLLOWING GASTRECTOMY

The technical difficulties encountered in resection for a marginal ulcer that has developed after gastrectomy are the more troublesome, the smaller the stomach segment left at the previous operation. On opening the abdomen, it is important to estimate as accurately as possible from the anatomic picture what obstacles will have to be overcome in performing the new radical operation. If certain unfavorable factors are obviously present at the outset, our standard radical plans must be modified accordingly. Such factors are (1) invasion of the whole remnant of the posterior gastric wall by the ulcer, (2) extensive penetration into the left lobe of the liver, into the spleen, or into the diaphragm. It is important also to determine from the anatomic picture before us whether a Finsterer operation has previously been performed, as is frequently the case when we are dealing with marginal ulcer following resection.

The prepyloric remnant of the antrum may be found to be densely covered by adhesions. Occasionally its excision will suffice to cure the hyperirritability of the fundus that has been the primary cause of the ulceration. After excision of the remaining antrum and closure of the duodenum, a jejunostomy is performed. The prolonged period of gastric rest thus secured may lead to permanent cure. One case, among four reported instances that illustrate this situation, is described on page 96.

In every case, before the radical operation for a post-Finsterer marginal ulcer is undertaken, the above described procedure should be given a trial. If clinical symptoms and X-ray evidence of ulcer persist after two months of jejunal feeding, or if they recur after withdrawal of the jejunal tube, the radical procedure should be resorted to. This became necessary in one of our cases.

The resection of the anastomosis and the adjacent gastric remnant is best begun by dividing the afferent and efferent segments of the jejunal loop. The proximal segment is usually long enough to permit of a subsequent end to end union with the distal segment; thus the difficulties caused by too short a loop, which is often found in the case of marginal ulcer of a posterior gastro-enterostomy are not encountered.

Next, the gastrocolic and hepatogastric ligaments are detached from the stomach, from a point above the anastomosis to one a short distance below the cardia, leaving only a small area of stomach with its ligamentous connections intact. The anastomosis is then freed by blunt and sharp dissection. If there has been considerable penetration, the ulcer crater should promptly be approached from without and freely exposed to view from both aspects, in order to facilitate the further manipulations.

After the jejunal stumps have been reunited, the new gastro-jejuno-stomy is made and the ulcer crater is packed; the final step, if desired, is the construction of a jejunostomy.

The small gastric remnant may become the seat of further ulceration later on and surgery may again be indicated, either because of severe pain that does not yield to medical treatment, or because of hemorrhage (p.98). Under these circumstances the possibility of a penetration into the diaphragm near the cardia must be reckoned with. If it is found that dense scar tissue around the esophagus will not permit of anastomosis with the jejunum, thoracic approach must be substituted for the abdominal route. The appropriate technic was described in 1937 in the publication of a case of bleeding ulcer of the cardia.

If the marginal ulcer has penetrated deeply into the retroperitoneal space, it may not be feasible to do a resection at all—in which case, if the gastric remnant is small, a preliminary jejunostomy is performed. If there is a larger gastric remnant, the following palliative procedure may be used, with the ad-



FIG. 109 PALLIATIVE RESECTION IN JEJUNAL PEPTIC ULCER AFTER INADEQUATE GASTRIC RESECTION

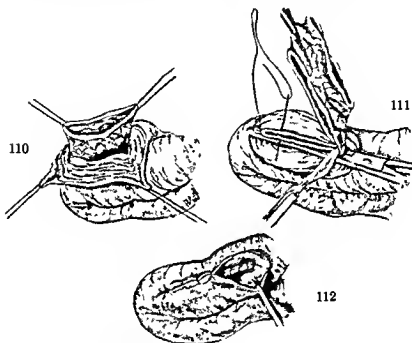
In view of the wide area of penetration, radical removal of the ulcer seems too hazardous. The stomach is detascularized and a large portion excised, as evident from the resection lines. The distal end of the stomach adjacent to the ulcer is left in situ

vantage that it obviates mobilization of the jejunum and stomach.

Stage 1. The stomach is divided at a point about 3 cm. proximal to the anastomosis, and after ligation of the afferent vessels, as large a portion as practicable is resected (fig. 109).

Stage 2. The mucosa of the distal gastric remnant is excised (fig. 110).

Stage 3. The distal gastric remnant is closed with two rows of invaginating sutures, the omentum being included for reinforcement (figs. 111, 112).



FIGS 110-112. PALLIATIVE RESECTION IN JEJUNAL PEPTIC ULCER AFTER INADEQUATE GASTRIC RESECTION

Fig. 110. Sleeve resection of mucosa and submucosa of remaining portion of stomach.

Fig. 111. The mucosa is excised and the mucosal stump closed by continuous catgut suture.

Fig. 112. A noninverting continuous seromuscular suture is placed to cover the mucosal stump

Stage 4. A new gastrojejunostomy and jejunojejunostomy are established.

This procedure is not properly termed "radical," and the ulcer is not resected. But under the given conditions, it is justified by the decreased operative risk.

GASTROJEJUNOCOLIC FISTULA

Any of the various types of marginal ulcer may break into the lumen of the colon, producing the serious clinical picture accompanying a gastrojejunal colic fistula. Because of its location, an ulcer of the posterior anastomosis is especially likely

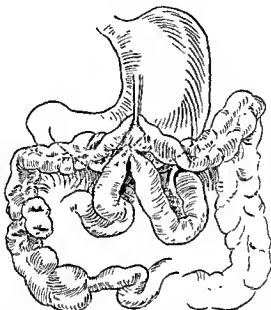


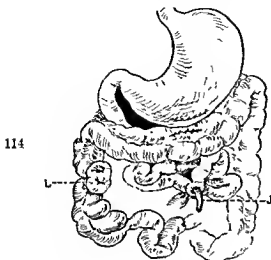
FIG. 113 PFEIFFER'S TWO STAGE OPERATION FOR GASTROJEJUNOCOLIC FISTULA

Stage 1. Exploration of lesions; ascending loop colostomy

(From Pfeiffer, D. B., and Kent, E. M., in Bancroft, F. W. *Operative surgery*.
Courtesy D. Appleton-Century Co.)

to produce this complication. The symptomatology need not be described in detail, but it should be remarked that symptoms may be minimal for quite a period, especially if the fistulous opening is small, permitting only gas to pass from the colon into the stomach. It is noteworthy that occasionally the patient's pain is relieved by the break-through, and even healing

of the ulcer has been known to result. In one such case the fistulous tract was found to be completely epithelialized and the ulcer healed. I have been unable to find any report of spon-



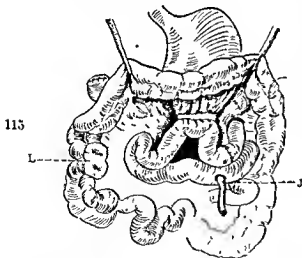
FIGS. 114-15. PFEIFFER'S TWO STAGE OPERATION FOR GASTRO-JEJUNOCOLIC FISTULA

L = loop colostomy
J = jejunostomy

Fig. 114. Stage 2, method 1. Excision of fistulous tract with repair of defects. Jejunostomy optional.

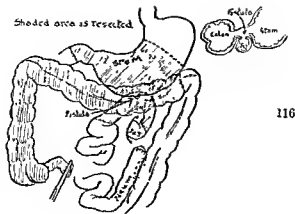
Fig. 115. Stage 2, method 2 (preferred). Partial gastrectomy, excision of fistula, repair of jejunum, restoration of continuity (Polya).

(From Pfeiffer, D. B., and Kent, E. M., in Bancroft, F. W.: Operative surgery. Courtesy D. Appleton-Century Co.)

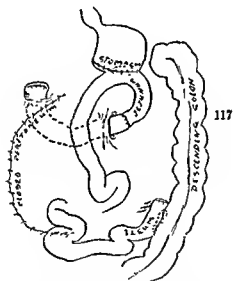


aneous healing of a gastrojejunocolic fistula, although theoretically this might occur.

Operation is indicated as soon as the diagnosis is established,



116



117

FIGS. 116-17. MANAGEMENT OF GASTROJEJUNOCOLIC FISTULA ACCORDING TO LABEY

Fig. 116. *Stage 1.* The ileum is cut off close to the ileocecal valve, the proximal end turned in, and the jejunum anastomosed laterally to the descending colon. The terminal distal ileal segment is turned in and dropped back into the abdomen to remain until the second stage of the operation. The shaded area represents the block of colon, jejunum, stomach, and duodenum to be removed in the second stage.

Fig. 117. *Stage 2 completed.*

(From Labey, F., and Marshall, S. *Surg., Gynec. & Obst.* 76: 641, 1943
Courtesy *Surgery, Gynecology and Obstetrics*)

with the primary object of closing the communication between stomach and colon. There is no rationale in performing a jejunostomy, despite the poor nutritional state in which such a patient comes to operation.

It is more logical to undertake a preliminary procedure by which the intestinal contents are diverted from the fistulous tract. However, establishment of a cecal fistula—a proposed measure that we have tried a few times—is not completely



FIG. 118. EXTENT OF RESECTION IN MARGINAL ULCER AND GASTROJEJUNO-COLIC FISTULA WITH REMOVAL OF OBSTRUCTED PORTION OF COLON

effective in achieving this. Neither the entire intestinal contents nor even all the intestinal flatus will escape via a cecal opening, as experience has shown. An artificial anus constructed from the ascending colon (Pfeiffer) operated more efficiently in this respect, and represents the method of choice (figs. 113-15).

Lahey transects the last loop of the ileum and then establishes an ileosigmoidostomy, as a preliminary step (fig. 116). We

are inclined to agree with Pfeiffer's criticism of this when he says: "Such exclusions do not completely exclude, since it has long been known that colonic contents, at whatever point introduced, pass readily backward and fill the entire colon . . ."

In the second stage, Lahey removes the remaining terminal ileum and the colon beyond the fistula. He then eliminates the anastomosis, or, if the patient's condition will permit,



FIG 119 RADICAL OPERATION FOR GASTROJEJUNOCOLIC FISTULA
Final view after resection of colon, jejunum, and stomach

resects both the stomach and the involved loop of intestine (fig. 117).

Lahey at his clinic has demonstrated excellent immediate results after this operation, despite the fact, as noted by Pfeiffer, that so extensive a colonic resection adds materially to the surgical procedure and is physiologically undesirable.

Pfeiffer, in describing Lahey's procedure, has illustrated by a drawing that the gastro-entero-stomy is eliminated but the stomach is not resected. In his latest publication, however, Lahey leaves no doubt that he regards subtotal gastrectomy

as the logical radical treatment for marginal ulcer. In such a case, one might expect a tendency to diarrhea to result.

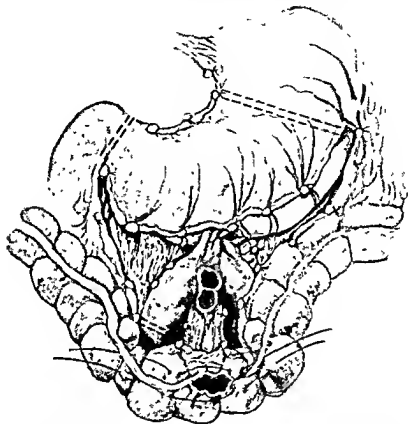


FIG. 120. RADICAL OPERATION FOR GASTROJEJUNOCOLIC FISTULA WITHOUT RESECTION OF COLON

After devascularization of the stomach, the colon is peeled away from the ulcer crater, and the resultant opening in the colon is closed transversely. Extension of the crater of the ulcer into the jejunal mesentery is visualized. The ulcer-bearing part of the jejunum is devascularized (dotted lines indicate extent of gastric and jejunal resection)

It seems to me, although I have had no personal experience with either method, that the procedure advocated by Pfeiffer must be less drastic and less hazardous than that of Lahey.

A consideration of the Lahey technic for gastrojejuno-colic fistula raises the question whether it is necessary or even desirable to resect the fistulous section of colon. Our own experience has been on the negative side. Among 11 cases, it

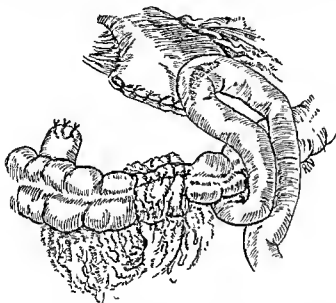


FIG 121 FINAL VIEW AFTER COMPLETION OF SECOND STAGE OF RADICAL OPERATION FOR GASTROJEJUNOCOLIC FISTULA

In this case the gastrojejuno-colic fistula was small. In the first stage, the fistula was closed and the stomach divided, and anterior gastro-enterostomy with entero-anastomosis was performed. In the second stage, resection of the excluded portion of the stomach was performed. The greater omentum covers the invaginated area of the colon.

(This type of two stage procedure is advisable only in the case of a small gastrojejuno-colic fistula without extensive inflammatory reaction)

was found necessary to resect the fistulous segment of the transverse colon in only 2, and in these the indication lay in the stenosis of the bowel adjacent to the fistula and not in the size of the breach in the wall. In the first case only a short piece

had to be resected, and end to end union of the colonic stumps without tension could be effected (figs. 118, 119). In the second case the resected segment was too long to permit this. The distal stump of the colon was inverted and dropped back into the peritoneal cavity, while the proximal stump was

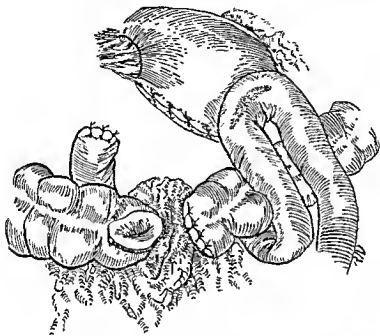


FIG. 122. RADICAL OPERATION FOR GASTROJEJUNOLCOLIC FISTULA

In this case an extensive resection of the transverse colon was obligatory. The distal stump was closed and the proximal stump was brought out as an abdominal colostomy

brought out as a colostomy. It was later possible to re-establish continuity by means of interposition of a pedicled loop of jejunum (figs. 122, 123).

In all the other cases the colon fistula could be closed by invaginating sutures without causing undue narrowing of the bowel lumen (fig. 119). In some, cecostomy had been effected previously, but, as mentioned above, with only slight resultant

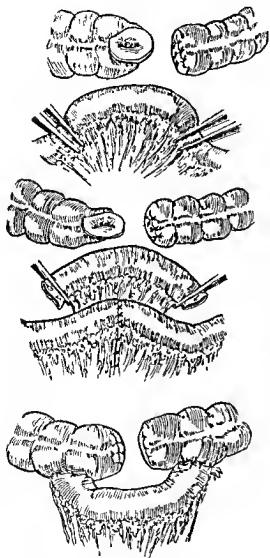


FIG 123 RADICAL
OPERATION FOR GAS-
TROSPLENOCOLIC FIS-
TULA

In a third stage operation in the case represented in figure 122, colon continuity was effected by a segment of small intestine with attached mesentery. The colostomy was closed intraperitoneally. Ileo-transverse colostomy was not advisable because of the extent of the blind loop of bowel that would be left behind.

improvement. A functioning ceco-tomy after the fistula had been sutured was possibly of some value.

This conservative treatment of colon fistula (i.e., without

transverse colon resection) implies free opening of the ulcer itself and thorough exposure of the colon wall surrounding the fistula, with all possible sparing of mesocolic vessels at the same time. It is amazing to find that in spite of dense scar tissue adjacent to the ulcer, the colonic wall itself is regularly only slightly damaged and the fistulous aperture is small

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